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ABSTRACT

Instructional Design Expert (ID Expert) is a prototype instructional design expert system which supports the instructional design phase of instructional system development. Phase 2 of ID Expert was implemented using S.1 expert system language on the VAX computer. The user interface was text-based, consisting of a question/answer dialogue primarily controlled by the program. The goals of phase 3 were to transport the system from the minicomputer environment onto a desktop, and to improve the user interface to support user-initiated actions in a highly graphic, interactive environment. There was a shift in emphasis from a rule-oriented expert system to a frame-based expert system. The set of frames together constitute an expert system distributed between Hypercard and Nexpert, and across the Hypercard frames as well, facilitating user-initiated interaction with these mini-experts. The object-oriented programming capabilities of Hypercard were utilized, allowing the explicit graphic representation of frames and their relations and the direct manipulation of the frames and their components. This report includes an introduction to phase 3 of the project; a description of the domain of ID Expert; a top level view of the system structure; and a detailed description of the system, including the system components, user interface, inferencing, and system outputs. A sample ID Expert system is described and a transcript is included. (GL)

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Design Document and Technical Report

Implementation of an Expert System for Instructional Design

Phase 3

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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Summary

Several important instructional design and development needs led to the development of the ID Expert. These include: the lack of sufficient numbers of experienced instructional designers; the need for tools to make the instructional design process more adequate while at the same time making it more efficient; the need for more adequate instructional design models in intelligent tutoring systems; and the need for more precision in the specification of instructional design theory.

The goals for phase 3 were to transport the system from the minicomputer environment onto a desktop, and to improve the user interface to support user-initiated actions in a highly graphic, interactive environment. These goals were accomplished. Additionally, three other important developments occurred.

First, there was a shift in emphasis from a rule-oriented expert system to a frame-based expert system. In a frame-based system, much knowledge previously represented as rules is captured by the programming that supports a particular frame. Each frame may be thought of as a template for information, with a number of slots into which information is placed as a result of interaction with the user. As a consequence of this change in emphasis, the number of rules separately coded (for execution by the Nexpert shell) dropped from over 200 to about two dozen.

The second development is closely connected with the one just mentioned. Each frame may be thought of as a "mini-expert" capable of reasoning in a very restricted domain. Together, the set of frames constitute a distributed expert system, distributed not only between Hypercard and Nexpert, but across the Hypercard frames as well. Interaction with these mini-experts is user initiated, decreasing dramatically the monolithic nature of the typical expert system interaction.

A final development was the use of the object-oriented programming capabilities of Hypercard. While not a true object oriented language, Hypercard does allow the explicit representation of frames and their relations graphically, and supports direct manipulation of the frames and their components. Hypercard proved its value as a rapid prototyping tool suited to the demands of the domain in which we employed it.

The ID Expert recommends those instructional design decisions which would occur after some front end analysis has been completed. It assumes that a subject matter expert has been consulted or is present during the consultation and that the subject matter content to be taught has been selected (job analysis is completed) and sample materials gathered. The system will assist in the instructional analysis and organization of this subject matter content but will not assist in the selection of the material to be included in the course.

The output from the prototype ID Expert is a design specification for a course. This specification can then be used by an instructional developer to implement the design using an appropriate media delivery system. This specification includes recommendations for: (1) instructional modules including the content and objectives for these modules; (2) course organization and sequence including menus, pre and post integrative modules and instructional modules; (3) one or more transactions for accomplishing each of the instructional functions for each module; and (4) detailed specifications for each of these transactions.

1.0 Introduction

1.1. Purpose of the project

Several important instructional design and development needs led to the development of the ID Expert. These include: the lack of sufficient numbers of experienced instructional designers; the need for tools to make the instructional design process more adequate while at the same time making it more efficient; the need for more adequate instructional design models in intelligent tutoring systems; and the need for more precision in the specification of instructional design theory.

Guidance for inexperienced instructional designers. It is not uncommon in many training environments for a professional to find himself or herself assigned to the preparation of training materials with only a minimum amount of formal training in instructional design, learning or related disciplines. Often the only recourse for these "assigned" instructional designers it to rely on their own training experience for guidance thus perpetuating inadequate practices or preserving the status quo. These inadequately trained instructional designers often are unable to adequately consider more appropriate learning principles and more effective instructional techniques in the training materials they must prepare. The primary purpose of the ID Expert is to capture some of the best instructional design and learning expertize available in a form that can serve as an expert consultant to these naive instructional designers thus enabling them to be more adequately guided in their instructional design efforts.

Tools for making instructional design more efficient. The hardware for new high technology instructional delivery systems is relatively inexpensive and available for wide spread adoption. Often these systems have been demonstrated to enable far more imaginative instruction than is possible with previously available delivery systems. However, the cost of developing materials for such systems is extremely high and continues to increase thus slowing the adoption of these technologies. Attempts to build authoring languages and systems have for the most part attacked only one aspect of these development costs, i.e. the programing effort. However, most of the development cost is not in programing (often

less than 25% of the total effort) but rather in instructional design. A second purpose of the ID Expert is to provide a design tool to facilitate the efficiency of this preprograming design effort. The ID Expert enables the designer to explore a wide variety of possible designs while simultaneously considering a wide range of contributing variables. The ID expert automates much of this decision making effort thus enabling the designer to much more rapidly formulate development specifications and to modify those specifications for different settings, student audiences and subject matter constraints.

Instructional models for intelligent tutoring systems. Significant progress has been made in developing advanced programing techniques that enable computer based instructional systems to demonstrate considerable intelligence. In the development of these advanced tools the instructional models involved have often been based on expediency or the previous educational experiences of the project investigators rather than on a careful analysis of the learning and instruction literature. Many of the developers of these systems are now reaching out for information about instruction and learning that can be incorporated into these advanced computer based instructional tools. A secondary purpose of the ID Expert is to capture some of the best instructional design and learning expertize available in a form of production rules that can more easily be incorporated into other intelligent instructional systems.

More precise instructional design theory. Much of the available information on learning and instruction is very nonspecific often consisting of broad generalities requiring considerable interpretation in order to convert these general principles into a specification for a specific instructional product. Another purpose of the ID Expert was to translate broad general instructional design and learning principles into specific production rules sufficient to enable the computer to reason with these rules and recommend specifications for the development of a particular product. The ID Expert thus becomes a model for the future specification of instructional design theory in a form that is more precise and thus more useful in prescribing educational practice.

1.2 Goals of Phase 3

Phase 2 of ID Expert was implemented using the S.1 expert system language on the VAX computer. The user interface was text-based, consisted of a question/answer dialog primarily under the control of the program.

Initially, the goals for phase 3 were to transport the system from the minicomputer environment onto a desktop, and to improve the user interface to support user-initiated actions in a highly graphic, interactive environment. Those goals were accomplished. Additionally, three other important developments occurred.

First, there was a shift in emphasis from a rule-oriented expert system to a frame-based expert system. In a frame-based system, much knowledge previously represented as rules is captured by the programming that supports a particular frame. Each frame may be thought of as a template for information, with a number of slots into which information is placed as a result of interaction with the user. As a consequence of this change in emphasis, the number of rules separately coded (for execution by the Nexpert shell) dropped from over 200 to about two dozen.

The second development is closely connected with the one just mentioned. Each frame may be thought of as a "mini-expert" capable of reasoning in a very restricted domain. Together, the set of frames constitute a distributed expert system, distributed not only between Hypercard and Nexpert, but across the Hypercard frames as well. Interaction with these mini-experts is user initiated, decreasing dramatically the monolithic nature of the typical expert system interaction.

A final development was the use of the object-oriented programming capabilities of Hypercard. While not a true object oriented language, Hypercard does allow the explicit representation of frames and their relations graphically, and supports direct manipulation of the frames and their components. Hypercard proved its value as a rapid prototyping tool suited to the demands of the domain in which we employed it.

1.3. Audience

The ID Expert is designed primarily for instructional designers who have had only minimal training in instruction, learning and related disciplines. Its purpose is to provide guidance in making instructional design decisions to the end that the products, developed using the instructional specification output from the ID Expert, will more adequately implement what is known about learning and instructional design.

A secondary audience for the ID Expert are experienced instructional designers. The ID Expert enables an experienced designer to play the "what if game" more efficiently by seeing how design specifications change when the parameters of the instructional situation are changed. The ID Expert considers a much wider variety of factors in making any given recommendation than is practical for designers to consider without such a tool. While the rules in the prototype are based on the best estimate of the instructional design domain expert used for the development of the system, the mechanism exists for the system to systematically consider data from a large number of experimental studies in making recommendations.

1.4. Environment

1.4.1. Software.

The prototype Instructional Design Expert is implemented using Hypercard (Apple Computer) and Nexpert Object (Neuron Data, Inc.) expert system shell.

1.4.2. Hardware.

ID Expert runs on the Macintosh series of personal computers. Minimum configuration is 1MB of main memory and two 800KB floppy disk drives. Development systems incorporate a 20MB fixed disk in place of one of the floppy drives.

2.0 Domain

2.1 Description of the Domain

An underlying premise of the instructional design theory involved in the ID Expert is that a primary determinate of appropriate course organization, content representation and transactions is content structure. Content structure is the organization of a knowledge domain showing the content components and their relationship to one another. Instantiating a content structure is a form of knowledge acquisition in which appropriate domain knowledge is acquired from the domain (subject matter) expert and organized in a way appropriate for a given goal, goal characteristics and student characteristics. A completely instantiated content structure would encompass all of the knowledge (content) representations necessary to implement an instructional system to teach this domain.

A fundamental premise of the instructional design theory underlying the ID Expert is that there are different kinds of instructional outcomes (Gagne, 1984) and that different types of content structures are appropriate for representing the knowledge necessary to the acquisition of a particular kind of outcome. Furthermore, the instantiation of a given type of content structure provides most of the information necessary to make appropriate recommendations for modules, the content of each module, the function(s) of each module, the objective(s) for each module, the course organization, the type of transactions within each module, and the content representation(s) required for each type of transaction. Therefore the ID Expert assists the designer to select the appropriate type of content structure for the goal, goal characteristics and audience characteristics of the course and guides the instantiation of this content structure.

2.1.1. Types of Content Structures

List. Lists are the most primitive form of content structure. An unordered list is really no structure. Lists can be ordered providing the most basic form of content structure. A list can be ordered on any dimension or attribute of the items in the list.

The next level of organization for a list is to cluster the items in a list forming the most primitive form of taxonomy. A PARTS taxonomy is an example of a clustered list where the subordinate nodes are parts of the superordinate node.

A list may be most appropriate for teaching specific facts or information. A list may be appropriate if the goal requires the student to:

- remember specific events, dates, persons, places or sources.
- remember a set of symbols.

Taxonomy. A taxonomy is an organization which organizes subordinate items under superordinate items. Taxonomies are usually represented by tree diagrams. The nature of the subordination determines different kinds of taxonomic structures.

Items in a list are more easily learned if they are clustered in groups of items where the number of items in each group is within the short term memory limits of the learner (The magic number seven plus or minus two). A PARTS taxonomy is an example of such a taxonomic clustering where the subordinate nodes are parts of the item identified by the superordinate node. A PARTS taxonomy is a content structure associated with remembering facts, parts of a device, etc.

A PARTS taxonomy is appropriate if the goal requires the student to:

- identify or name the parts and/or functions of a device or object.

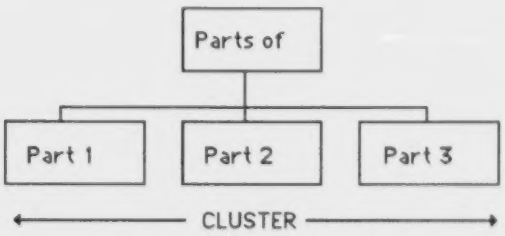


Figure 2.1 Illustration of PARTS Taxonomy

A KINDS taxonomy is also represented by a tree diagram where subordinate nodes represent kinds of the item represented by the

superordinate node. A KINDS taxonomy is fundamental for identifying concepts. A KINDS taxonomy is appropriate if the goal requires the student to:

- discriminate two or more different kinds of objects, events or symbols from one another.
- sort objects, events or symbols into categories.
- identify different objects, events or symbols as instances of a more general category.
- order a series of objects, events or symbols relative to some dimension.

Other forms of taxonomy structure include PROPERTIES or FUNCTIONS taxonomies where the subordinate nodes are respectively properties or functions of the superordinate node.

A PROPERTIES taxonomy is most appropriate for teaching associated information about an object or process. A properties taxonomy is appropriate if the goal requires the student to:

- describe the characteristics of an object or process.
- identify a characteristic as a property of a particular object or event.

A FUNCTIONS or CONDITIONS taxonomy is most appropriate for teaching a set of related procedures each of which are necessary to accomplish some purpose when the execution does not follow a particular path. A functions taxonomy is most appropriate if the goal requires the student to:

- select and/or execute (do) an appropriate action from a set of alternative actions.

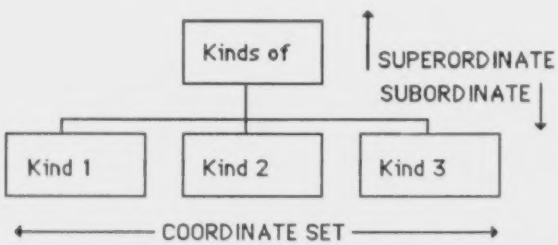


Figure 2.2 Illustration of KINDS Taxonomy

Path Algorithm. A path algorithm is usually represented by a flow chart which indicates steps and sequence for a series of actions or activities. Path algorithms are appropriate when the orientation is HOW to do something and the learner must acquire a procedure. A path algorithm is appropriate if the goal requires the student to:

- operate a specific device or any of several similar devices.
- assemble or disassemble a specific device or any of several similar devices.

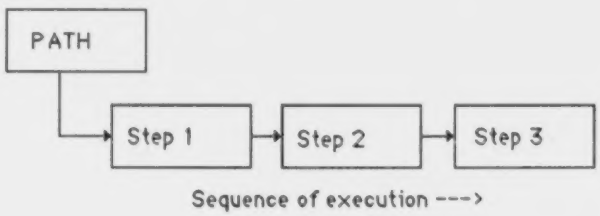


Figure 2.3 Illustration of PATH algorithm

Decision Algorithm. A DECISION algorithm can also be represented by a flow chart or by a decision tree. Each branch represents a choice by the learner. Following a series of choices leads to a decision or conclusion. Whenever the student must select between two or more alternatives, such as choosing a function, classifying an instance of a concept, or selecting an appropriate rule, a decision algorithm is implied. Decision algorithms are usually combined with other content structures to form complex structures such as concept classification or selecting from two or more functions and executing the procedure associated with the function.

A decision algorithm is appropriate if the goal requires the student:

- to decide between two or more alternatives or options.

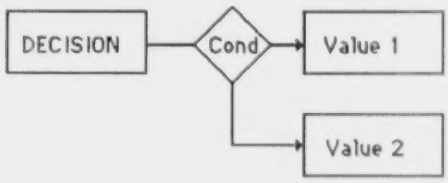


Figure 2.4 Illustration DECISION algorithm

Causal nets. Casual nets are usually represented by "and/or" graphs and represent WHY something operates as it does. Causal nets are beyond the scope of the prototype system and are not illustrated or explained in this Design Document and Technical Report nor are they recommended by the prototype system. Future expansions of the ID Expert will include causal net content structures.

A causal chain is most appropriate for teaching natural principles and processes. A causal chain is most appropriate if the goal requires the student to:

- predict the outcome for an event or series of events.
- derive or formulate a rule or principle.
- design or develop a product or communication.

An event chain is most appropriate for teaching cycles in nature and other sequential processes. An event chain is most appropriate if the goal requires the student to:

- describe a sequence of actions or activities.
- predict the outcome for an event or series of events

2.1.2. Compound Content Structures (Elaboration)

The previous paragraphs have identified some of the basic forms of content structure. In real world subject matter these simple forms must be expanded to accommodate the details of the knowledge to be taught. The fundamental principle underlying the elaboration of content structure is the limitation on short term memory. In order to be remembered and learned efficiently content must be organized to limit the number of items under consideration at any moment to approximately 7 +/- 2. This clustering of information enables the student to handle great complexity by "chunking" the information so that there is only a limited amount of information in short term memory at any one time.

A PARTS taxonomy is elaborated by identifying parts, subparts, subparts of subparts, etc. The rule is that at a single level of a branch in the tree their are never more than 7 items. If the content requires more items then an intermediate clustering should be created to enable the magic number 7 rule to prevail.

A KINDS taxonomy is elaborated in a similar way. Kinds are identified, then kinds of kinds, etc. Again at any level of any branch the number of coordinate items should not exceed 7.

A PATH algorithm is elaborated by identifying substeps of steps, and substeps of substeps, for as many levels of complexity as are necessary consistent with the 7+/- 2 rule.

PATH algorithms can also be elaborated by including loops and branches in the path. The ID Expert does not yet accommodate this type of elaboration but future versions of the system will. Control steps include classic procedural functions such as IF THEN ELSE, WHILE TRUE DO, REPEAT UNTIL TRUE, FOR N TIMES REPEAT. Each of these conditional structures imply a decision function and hence elaboration which leads to branching which may require a complex content structure where a decision algorithm is nested within a path algorithm.

DECISION algorithms are elaborated by as many decision steps as may be necessary to accommodate the decision process being taught. Decision algorithms are usually combined with other content structures forming complex content structures.

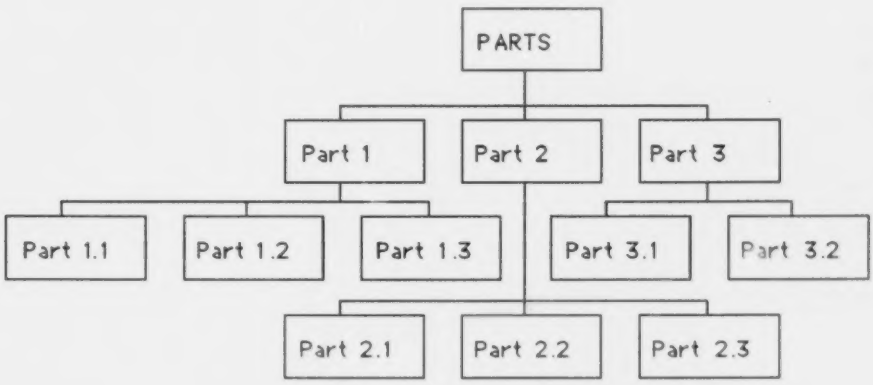


Figure 2.5 Illustration of Elaborated PARTS taxonomy

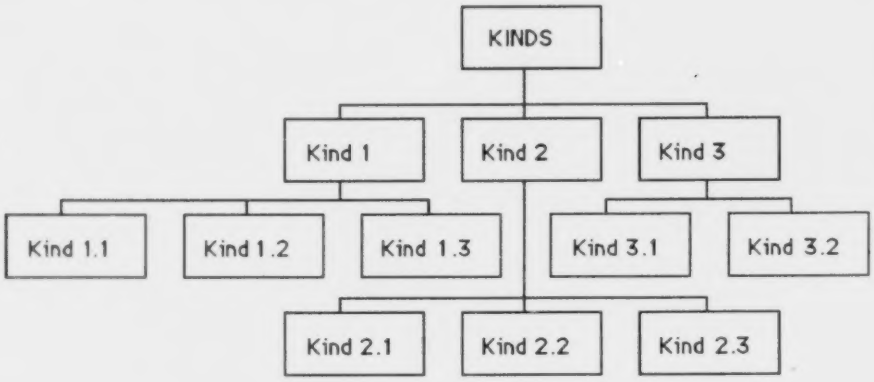


Figure 2.6 Illustration of Elaborated KINDS taxonomy

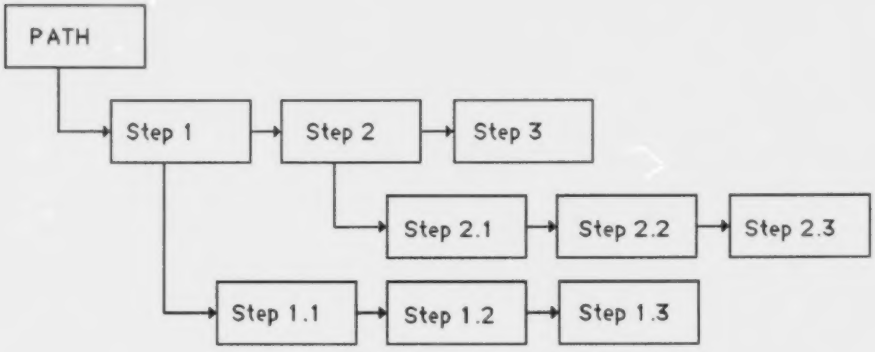


Figure 2.7 Illustration of Elaborated PATH algorithm

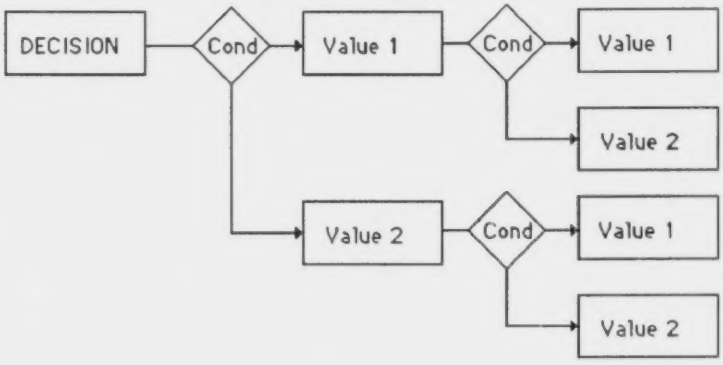


Figure 2.8 Illustration of Elaborated DECISION algorithm

2.1.3. Complex Content Structures (Nesting)

Most objectives involve more than a simple content structure or even a compound (elaborated) content structure. For most instructional situations two or more simple content structures are combined to form a complex structure. We speak of one simple content structure being nested within another.

The PATH consultation of the ID Expert concludes with recommendations for content structures which are all complex in that they combine two or more simple content structures. Some of the combinations included include a PATH algorithm with a PARTS taxonomy as a prerequisite; a CONDITIONS taxonomy (a form of a KINDS taxonomy) combined with a PATH algorithm for each condition with a PARTS taxonomy as a prerequisite. A KINDS taxonomy combined with a CONDITIONS taxonomy each associated with a PATH algorithm and a series of PARTS taxonomies.

One of the contributions of the ID Expert is the identification of the rules which determine which combination of simple content structures is associated with a given learning outcome and set of learning conditions. Whereas there are only a few basic content structures there can be many different complex content structures.

2.2 Portion of the Domain Addressed by Phase 3

The ID Expert is limited to instructional design decisions commencing after some front end analysis has been completed. It assumes that a subject matter expert has been consulted or is present during the consultation and that the subject matter content to be taught has been selected (job analysis is completed) and sample materials gathered. The system will assist in the instructional analysis and organization of this subject matter content but will not assist in the selection of the material to be included in the course.

The output from the prototype ID Expert is a design specification for a course. This specification can then be used by an instructional developer to implement the design using an appropriate media delivery system. This specification includes recommendations for: (1) instructional modules including the content and objectives for these modules; (2) course organization and sequence including menus, pre and post integrative modules and instructional modules; (3) one or more transactions for accomplishing each of the

instructional functions for each module; and (4) detailed specifications for each of these transactions.

The current implementation of the ID Expert provides guidance in preparing specifications for teaching concepts and device operation procedures.

Three kinds of content structure: a PARTS of taxonomy, a "KINDS of taxonomy" and a "PATH algorithm" are primarily supported.

Parts Taxonomy: A parts taxonomy defines the parts of an entity including their location and function.

Kinds Taxonomy. A kinds of taxonomy is most appropriate for teaching concepts or goals involving classification or decision making. A kinds of taxonomy is appropriate if the goal requires the student to:

- discriminate between different kinds of symbols, objects or events.
- sort objects, events or symbols into categories.
- order a series of events, symbols or objects on some continuum.
- identify different objects, events or symbols as part of a more general category.

A kinds of taxonomy is usually represented by a tree diagram consisting of a superordinate node under which are a set of subordinate nodes. The subordinate nodes under a given superordinate node are called a coordinate set. The connecting lines stand for the phrase "kind of" and the diagram is interpreted by indicating that a given subordinate node is a "kind of" its superordinate node. Figure 2. 3 illustrates these relationships.

The following example illustrates an incomplete "kinds of " taxonomy. The superordinate node is Pumps. The subordinate nodes of pump are piston pump, centrifugal pump and jet pump. The concepts piston pump, centrifugal pump and jet pump form a coordinate set of concepts. A piston pump is a "kind of" pump. A centrifugal pump is a "kind of" pump, etc. The diagram is expanded to show a second level of concepts, ie kinds of piston pumps. The subordinate nodes of piston pumps are piston pump, vane pump, lift pump, and diaphragm pump. The concepts piston pump, vane pump, lift pump and diaphragm pump form a coordinate set of concepts. A

given "kinds of" taxonomy can be elaborated to have many levels of coordinate concept sets.

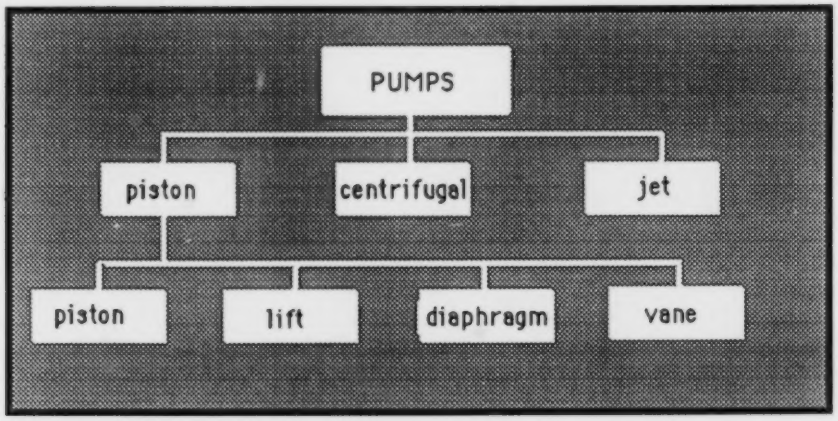


Figure 2.9 Illustration - Kinds of Pumps

Path Algorithm. A path algorithm is most appropriate for teaching procedure goals involving the execution of a series of steps. In the ID EXPERT prototype path algorithms have been identified for goals involving the operation or assembly of devices as follows:

- operate a specific device.
- operate any of several similar devices or pieces of equipment.
- assemble or disassemble a specific device.
- assemble or disassemble any of several similar devices or pieces of equipment.

A path algorithm is usually represented by a flow chart where each box indicates a step to be executed. A step consists of the following components: identification of the object, an action related to the object, a result of the action, and a consequence of the action.

A result is the change in the object that results from the action (e.g. a switch changes position). A consequence is some event or activity caused by the action (e.g. a motor starts). The lines between boxes represent the sequence of execution.

The example shows an incomplete analysis for the operation of a spread sheet. The content structure shown involves a complex content structure involving parts of the spreadsheet and a path algorithm.

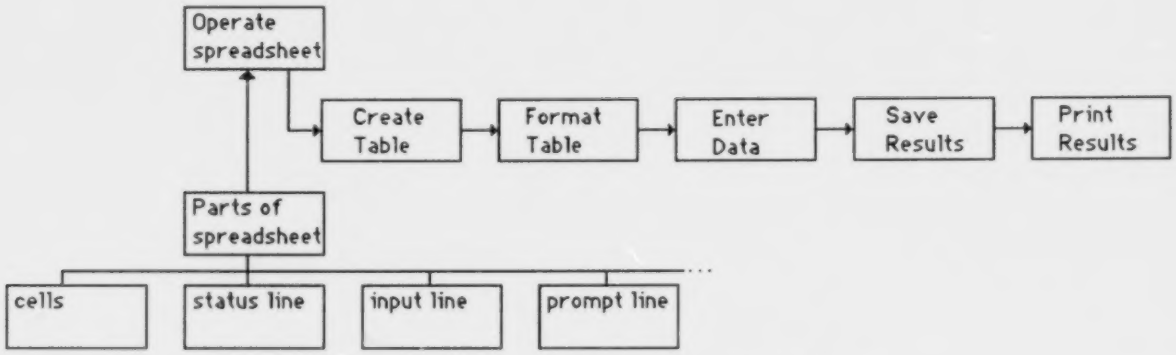


Figure 2.10 Illustration - Operating Spreadsheet

2.3 Strategy for Addressing Domain

The three major functions of ID Expert -- content structure, course organization, and transaction specification -- are tightly interrelated. Hence it is necessary, in order to address instructional design in a meaningful way, to approach all three of these functions simultaneously.

The strategy taken in the prototype development, therefore, is to work on all three areas, but within each area to limit the breadth of the investigation. Within each area a restricted part of the domain has been selected for in-depth experimentation.

2.4 Portion of the Domain Not Addressed by Phase 3

ID Expert is not yet a general purpose instructional design consultant. The current implementation is limited to three types of content structure and related instructional objectives. These are "parts of taxonomies", "kinds of taxonomies" (concepts) and "path procedures" (device operation procedures). While these three types of structure encompass a large body of instructional materials there are many other types of content structure which would require different modules, course organizations and transactions than those recommended by the present prototype. The system could be expanded to include these other instructional outcomes but recommending specifications for these other types of outcomes is beyond the scope of the present implementation.

The support within the current prototype for integration of related goals is very limited. Each goal is dealt with independently of other goals. Within goals, the integration of related content structures is

still limited, as in the area of integrating conditional knowledge within procedures.

The specifications do not include the management information necessary for determining on-line advisor rules for assisting the student in the question of when to begin the next transaction or which transaction should be next. This information could also be added to the system but is not included in the prototype.

The ID Expert makes no assumptions about media delivery system. It recommends transactions that are appropriate for teaching the objectives of the course without regard for how these objectives may be implemented. The descriptive material in this report often uses computer based instruction as a way to illustrate the transactions recommended but the recommendations are not limited to CAI or Interactive Video. The system could be expanded to assist with the media selection but the current implementation of the system does not include guidance for media selection.

The ID Expert does not include many of the detailed specifications necessary for preparing delivery in a given media. Specifications for such details as answer processing, error checking, screen design, program structure, data structures and programing are not included. Rules governing these detailed specifications could be added to the system but are not included in the present implementation.

The ID Expert is not an authoring system or language. In contains no screen editors, graphics editors, or other tools for preparing CIA or Interactive video learning materials.

3.0 Top Level View of System Structure

ID EXPERT is a consultation system which gathers necessary information from the user/designer and then makes instructional design recommendations to the user. As discussed earlier, the system is frame based. Each frame supports both the acquisition and display of course information. In addition, certain frames display recommendations based on the consultation. The following is a list of the frames in ID Expert:

- Introduction frame
- Course information frame
- Student characteristics frame
- Course goal frame

- Entity frame
- Activity frame
- Content structure frame
- Concept information frame
- Coordinate set information frame
- Parts-of taxonomy frame
- Kinds-of taxonomy frame
- Path hierarchy frame
- Course organization frame
- Transaction strategy frames.

The phase III prototype has five distinct phases: (1) Information gathering concerning student characteristics and content characteristics. This phase uses the student characteristics frame, the course goal frame, the entity frame and the activity frame. (2) Based on this information the system recommends a particular content structure to the user. The system then assists the user to instantiate and elaborate the recommended content structure in terms of the specific content to be taught. This phase uses the content structure frame, the concept information frame, the parts-of-taxonomy frame, the kinds-of-taxonomy frame and the path hierarchy frame. (3) Based on this content structure the system recommends a course organization, which identifies modules to instruct the content structure. This phase uses the course organization frame. (4) For each module in the content structure the system recommends a transaction strategy. This phase uses the transaction strategy frame. (5) Finally the system selects a transaction shell for each transaction in the transaction strategy. The fifth phase in the ID process is merely illustrated for the phase III prototype. The system will eventually include the ability to develop each transaction for delivery to the student. Frames for each transaction will be developed for future versions of the system

4.0 Detailed Description of System

4.1 System Components

Documentation on the ID Expert frames is presented in terms of the help a user receives in using each frame.

4.1.1 Introduction Frame

OPERATION: Information gathering

The INPUT choice on the main menu bar of ID EXPERT contains four items:

- Course Information requests the title, author, date, and description of the course.
- Student Characteristics requests information about your students.
- Content Information requests information about your goals and subject matter.
- Environment Information requests information about the instructional setting.

The information you provide is used by ID EXPERT to make design recommendations.

OPERATION: Reasoning

The EXPERT CONSULTATION item under the OPTION choice from the main menu bar causes ID EXPERT to use the information you have provided about the course, the audience, the goals and subject matter and the instructional environment to make recommended design decisions about content structure, course organization and instructional transactions. The results of the consultation can be seen by choosing an item from the SPECIFICATION choice from the main menu bar.

OPERATION: Specification

The SPECIFICATION choice from the main menu bar contains three items:

- Content Structure shows the organized subject matter components you've provided.
- Course Organization shows the sequence of modules recommended for the course.
- Transactions shows the recommended interactions for teaching each module.

These recommended specifications are a result of ID EXPERTS reasoning capability using the information you have provided about the students, subject matter and environment.

OPERATION: Authoring

Once specifications have been recommended ID EXPERT enables you to create actual lesson materials which implement these specifications. Select a module from the course organization or transaction specification and then select AUTHORING from the main menu. You are shown a transaction shell configured consistent with the specification. The authoring procedure will request additional information necessary for the interaction.

You can try your lesson by selecting the TEST LESSON item from the OPTION menu. The authoring capabilities of the system are not implemented for the phase III prototype.

OPERATION: Explanation

The EXPLANATION item on the main menu bar enables you to study the instructional design theory and research on which the recommendations of ID EXPERT are based.

- RULES will show you the reasoning for a given recommendation in the specification.
- GUIDELINES will discuss how the rule(s) should be applied.
- REFERENCES will cite sources on which the rules and guidelines are based.

Related Guidelines and References present only those related to the rule(s) cited. The explanation system is not implemented for the phase III prototype.

OPERATION: Controlling ID Expert

ID EXPERT is under your control. Select desired items from the main menu

- OPTION allows you to return to this introduction, cause the system to reason, test a sample lesson (not yet implemented), or obtain help.
- INPUT allows you to provide information about students, content and environment.
- SPECIFICATION shows you ID EXPERT's recommendations.
- AUTHORING allows you to create sample transactions (not yet implemented).
- EXPLANATION shows you rules, guidelines and references for the recommendations (not yet implemented).

USING ID Expert

ID EXPERT includes context sensitive HELP. Whenever you need directions about how to use the system merely select HELP from the the OPTION menu.

Hypertext (pop-up information) is available for individual items on each screen. For example on the introduction card click and hold on any item for a more complete description.

When you first start ID EXPERT you will noticé that most of the items for each option on the main menu are dim and cannot be selected. You must select either "New Course" or "Load Course" from the FILE option of the main menu before you can begin to design a course.

"New course" requests a file name, creates a data file for a new course, and takes you to the course information card. Hypercard creates a new stack representing for each course you design.

"Load course" gives you a list of available files; select the file name of a previously identified course and continue your design work. This option allows you to load courses you have previously designed or have begun to design.

Select "Introduction" from the OPTION menu to return to the introduction card.

4.1.2. Course Information Frame

This frame contains user-entered information that is solely for the user's benefit, and is not used by ID Expert. This includes a course title, description, name of the author and date of creation.

4.1.3. Student Characteristics Frame

STUDENT CHARACTERISTICS are information used by ID EXPERT to recommend course organization and transactions.

To select a value for a characteristic click on the information box next to the characteristic. You will be shown a pop-up menu containing the legal values you can assign to the characteristic. To select click on the desired value. If you do not want to change the assigned value select CANCEL. For a definition of each of the value options select HELP.

The PRESCRIBE choice from the option menu allows ID EXPERT to use its expertize to recommend an appropriate value for the learner characteristic under consideration. When you select PRESCRIBE you will be asked for additional information which will enable ID EXPERT to recommend an appropriate value.

[PRESCRIBE has been implemented only for MOTIVATION.]

Student characteristics include locus of control, motivation, familiarity, ability, and role.

LOCUS OF CONTROL refers to whether or not a student feels in charge of the situation. When students feel that they are in control they are willing to make decisions and to direct their own activities. When students feel that others are in control they are more willing to let others direct them and make decision for them.

Internal locus of control -- students generally feel that they are in control. External locus of control -- students generally feel that others are in control.

If students are managers, supervisors or other leaders their orientation is likely to be internal. If the students are not in a leadership position their orientation is often external.

If you have data on the general orientation of the students whether from formal tests of locus of control or from observing the students this information is helpful in making instructional decisions.

MOTIVATION refers to the level of interest and the persistence with which students are likely to pursue the instruction.

For the prototype version of the system you should indicate the motivation for the students as a whole. Later versions of the system will consider the motivation of the individual student.

High motivation -- The students are likely to work hard, are interested in the subject matter and perceive that learning the material will be of benefit to them.

Moderate -- The students are somewhat interested, are engaged in the instruction to obtain some other benefit such as a promotion but will likely not persist if the instruction is difficult or if there is an easy way through.

Low -- The students are not interested in the content, are in the instruction because someone else made them, are not likely to receive any additional benefit as a result of the instruction and are not likely to persist if there is an easy way out.

An expert consultation is implemented for motivation. This is documented under the heading "inferencing" later in this report.

FAMILIARITY refers to the extent to which a student has already studied the material be be presented. In the training environment we often retrain students in material that has already been studied. The purpose of the instruction is to refresh the student's skills. On the other hand the material may be completely new to the student. A student may also have studied similar material and is thus moderately familiar with the content.

High familiarity -- The students have studied the same content before and this course is to refresh their skills.

Moderate -- The students have studied similar materials but this material probably contains some new information or more detailed material than that which has been previously learned.

Low -- the students have not studies the material before. All or most of the material to be presented is new to them.

ABILITY refers to the general aptitude of the student. Some students are more intelligent than others. Some students have special aptitudes in areas relevant to the subject matter (such as visual ability or mathematical ability).

The prototype system considers the general ability of the entire group of students. Later versions will consider the ability of the individual.

High ability -- The students are very capable learners, they catch on fast, they have special abilities that are relevant to the tasks to be learned.

Moderate -- The students are able learners but may lack some of the special skills that are relevant to the tasks to be learned.

Low -- The students are not very capable learners, they have difficulty grasping the material, they lack the special skills that are relevant to the task to be learned.

STUDENT ROLE refers to the situations in which the student will use the information to be learned from the instruction. Some situations require only an overview while in other situations the learner must have mastered the skills involved. Some situations require the ability to perform procedures in a routine way while in other situations the student must understand the underlying principles involved.

CONSUMER role -- The student needs general information but does not need a detailed knowledge of the tasks to be learned.

SUPERVISOR -- The student will direct the work of others, needs to understand the tasks at a general level, but does not need detailed skill in the tasks.

TECHNICIAN -- The student will actually execute the acquired skills and will need to be able to perform the tasks well in performing a service or producing a product.

PROBLEM SOLVER -- The student needs to understand how a device or process works in order to predict outcomes, derive new rules or procedures, or design new products or communications.

4.1.4. Course Goal Frame

COURSE GOAL: In order to build the content structure, you to must first identify one or more course goals and the entities, activities, processes and/or causes associated with these goals.

To add a goal, click and hold on either the label or identifier box opposite the next available number until the pop-up menu appears. While still holding the button drag to your choice of add goal, delete goal, change label or change identification and release the button. To add a goal a dialog box will request a label and identification. Be careful when you delete a goal as all the information associated with the goal will be deleted as well.

Click the note box to add any amount of notation to your goal.

At least one entity (object, device, person, symbol, place) must be associated with every goal . After identifying a goal click the entity box to provide information about these entities.

A goal may also involve activities, processes and/or causes. Click associated boxes to provide information about these components.

COURSE GOAL -- NUMBER

ID EXPERT automatically assigns a number to each of your course goals. These numbers are used by the system to make sure that content structures and course organizations correspond to the appropriate goal. Only 7 goals are shown on this card, but have no fear, you can have as many goals as you like, just point to any box, choose add a goal and you will be shown a new card.

CAUTION: When you delete a goal, all goals are moved up and the numbers reassigned. If you are keeping track of goal numbers off line be sure to note these number changes.

COURSE GOAL -- LABEL

This is a short name used by the system in the content structure and the course organization. The number of characters should be limited to about 15.

The identifier can be a longer name for the goal and the note can be as much information as you want. Try to be as mnemonic as possible

in choosing these labels to make your work easier as you develop your course.

COURSE GOAL -- IDENTIFIER

This is a longer description of the course goal. This identifier is used by the system to help you identify a course goal. It can be as long as the space shown. The system will allow you to enter a longer identifier but any words appearing beyond the box will not be visible.

Make the identifier as descriptive as possible. If you need more information concerning your goal use the note to enter as much information as you want.

COURSE GOAL -- NOTE

NOTE is a comment file for your information only. This note can be as long as you want within reason. The system does not use any of the information in this file. However, you may find it helpful to keep track of references to resources, the date you created the goal, who wrote the goal in the case of several authors, a more detailed description of the goal, etc.

You may find it helpful to establish some notation standards for your organization and suggest that everyone involved use the note file to document your work.

COURSE GOAL -- ENTITY

Every course goal involves objects, devices, persons, symbols, or places. Learning to identify these entities and their parts, understand how these entities work, use these entities to accomplish some purpose, or understand why these entities work is the essence of instruction. Providing content information begins with the identification of the entities involved and their characteristics.

Clicking on the entity box will take you to a card which will request you to list the entities associated with your goal and indicate some of their characteristics.

COURSE GOAL -- ACTIVITY

Many goals require the learner to engage in some activity with regard to the entities previously identified. The purpose of these activities is usually to accomplish some purpose.

If your goal involves some activity for the learner to learn then you should click on the activity box corresponding to your goal. You will be shown a card which will request that you list the principle activities involved in your goal and some of the characteristics of these activities.

COURSE GOAL -- PROCESS

Processes refer to those series of events that characterize our world. Most entities go through a series of phases or stages. What happens in one phase usually affects what will happen in the next phase of the process.

If your goal requires the learner to understand such a series of events or to make predictions about subsequent phases given the conditions of a current phase in a process then you should click the processes box corresponding to your goal. You will be shown a card which will request a list of the processes involved and some of their characteristics. (Process is not yet implemented for the phase III prototype.)

COURSE GOAL -- CAUSE

Often students are required, or desire, to know why certain events occur or why changes at one stage in a process results in changes in subsequent phases.

If your goal involves a student knowing why some event or sequence of events occurs or why some entity operates as it does then you should click the cause box corresponding to your goal. You will be shown a card which will you to list the causes (principles or theories) associated with your goal and some of the characteristics of these causes. (Cause is not yet implemented for the phase III prototype.)

4.1.5. Course Goal: Entity Frame

ENTITY

Every course goal involves objects, devices, persons, symbols, or places. A given goal can be associated with up to 7 different entities.

If a given goal requires more than 7 entities it is probably too complex and should be divided into two or more course goals.

Click and hold for pop-up menu to add, change, delete an entity. Provide a label which identifies each entity. Choose these labels carefully they will be used in subsequent content structure diagrams and course organization diagrams.

Use notes to provide additional description of an entity.

GOAL NUMBER

This is the Goal number supplied by the system. This number is used by the system to keep track of information associated with this goal. The entities supplied below will be associated with this goal. If you wish to specify a different goal return to the COURSE GOAL card and select the entity box associated with the goal you wish to consider.

If you delete a goal the numbers will be reassigned. The system will remember to keep the entity information associated with the new goal number.

IDENTIFIER

This is the identifier you supplied on the COURSE GOAL card. The entities supplied below will be associated with this goal. If you wish to provide entities for a different goal return to the goal card and select the entity box corresponding to the goal you wish to specify.

NOTES

NOTES is a comments file for your information only. A note can be as long as you want within reason. The system does not use any of the information in this file.

TYPE

Course organization and transactions depend in part upon the type of entity involved. Entity types include:

- Object/Device -- Articles, substances, machines, tools, products, etc.
- Person -- Beings, people, creatures, individuals, animals, etc.

- Event -- Occurrences, episodes, happenings, occasions, etc.
- Symbols --Notation, numbers, language, characters, marks, signs, emblem, figures, etc.
- Place -- Location, situation, position, region, site, geography, etc.

PREVIOUSLY LEARNED

To be complete it may be desirable to identify an entity for which the learner already knows the name of its parts, their location and function; and can already identify the different kinds of the entity. Merely check the "PREVIOUSLY LEARNED" box corresponding to this entity and it will be treated as prerequisite information rather than primary information for the content structure and the related transactions.

GENERALITY

The entity can be either a specific object, event, person, set of symbols, place or it can be a set of different kinds of the entity.

- SPECIFIC -- One particular object, person, event, place, set of symbols.
- CLASS-- A particular entity consisting of a set of similar particular cases which may vary along one or more dimensions.
- DISCRETE SET -- A set of different categories or kinds of the entity each of which may be a specific entity or class of entities.
- ORDERED SET -- Different entities which can be ordered along one or more dimensions. Regions of the continuum may be labeled by category names.
- GENERALIZE -- A general category which includes two or more different categories.

4.1.6. Course Goal: Activity Frame

ACTIVITY

A goal may consist of one or more activities associated with a given entity. An activity is a series of actions carried out by the learner. A given goal can have up to 7 different activities. If 7 activities are not

enough perhaps you should consider dividing your goal into two or more goals.

GOAL NUMBER

This is the Goal number supplied by the system. This number is used by the system to keep track of information associated with this goal. The activities supplied below will be associated with this goal. If you wish to specify activities for a different goal return to the COURSE GOAL card and select the activity box associated with the goal you wish to consider.

If you delete a goal the numbers will be reassigned. The system will remember to keep the activity information associated with the new goal number.

IDENTIFIER

This is the identifier you supplied on the COURSE GOAL card. The activities supplied below will be associated with this goal. If you wish to provide activities for a different goal return to the goal card and select the entity box corresponding to the goal you wish to specify.

NOTE

NOTE is a comment file for your information only. A note can be as long as you want within reason. The system does not use any of the information in this file.

TYPE

Course organization and transactions depend in part on the type of activity involved. The type of activity possible is in part dependent on the type of entity involved.

Activities which are associated with Object or Device type entities are:

- OPERATE -- run, work, manipulate, drive, steer, pilot, play, perform on, use, guide some object, machine, tool, thing.
- ASSEMBLE/DISASSEMBLE -- put together/take apart, fix, repair, collect some object, machine, tool, thing.

- TROUBLE SHOOT -- detect and correct errors in some device, tool, machine, thing.

Activities that are associated with person or event type entities are:

- INTERACT -- communicate with, direct, supervise, control other persons or creatures.
- PERFORM -- participate in some event.
- JUDGE -- evaluate the activities of other persons or creatures.

Activities which are associated with symbol type entities are:

- EDIT -- detecting and correcting errors in a symbolic communication.
- COMPUTE --using arithmetic or mathematics to manipulate numbers or solve problems.
- REPORT -- preparing a form of standardized communication.
- COMPOSE -- creating a unique communication.

- PREVIOUSLY LEARNED

To be complete it may be desirable to identify an activity which the learner can already execute. Check the "PL" box corresponding to this activity and it will be treated as prerequisite information rather than primary information for the content structure and the related transactions.

GENERALITY

The activity may be a specific sequence of actions or it may be a set of similar but distinct activities.

- "Specific if the actions are the same from one occasion to the next.
- "Class" if a set of similar but distinct actions are involved.
- "Discrete set" if different kinds of actions are involved.
- "Ordered set" if the actions can be ordered on some dimension or continuum.
- "Generalization" if the focus is to recognize different kinds of actions as all the same kind of general action.

CONDITION

An activity may be a single sequence of actions or it may consist of a set of different action sequences each of which is appropriate under certain conditions.

INVARIABLE means that the activity consists of a single sequence of steps that are performed in the same way and the same order from one situation to the next.

CONDITIONAL means that the activity consists of several different sequences of steps each of which are appropriate under particular circumstances (conditions). For example for the activity "use a word processor" there are different steps to get a file, save to a file, enter text, move text, etc.

LIMITATION

Some activities can be executed or simulated in the learning environment in a way very similar to that possible on the job. Other activities cannot be executed or simulated in the learning environment because of expense, safety, lack of appropriate simulation equipment, etc.

INSTRUCTION means that the activity can be executed in the instructional situation or that the instruction can be simulated in the instructional situation.

ON-THE-JOB means that because of hazard, expense, or other limitations that the activity can only be executed in the real world performance situation. Selecting this option will limit the transactions available to judging the adequacy of the activity rather than actually executing the activity.

ENTITIES

An activity is associated with a given entity. The learner either uses an entity in carrying out an action or the learner acts upon the entity by the action. If two entities are involved define a separate activity for each entity. Two activities can both use the same entity.

4.1.7. Content Structure Frame

CONTENT STRUCTURE

Content structure shows the individual elements of subject matter and how they are related to one another. Content structure is determined by content or instructional analysis. ID EXPERT guides you in this content analysis activity. The type of content structure used depends on the characteristics of the entity and activity. Based on the content information you have provided ID EXPERT selects the appropriate type of content structure. You merely elaborate on the entities or activities you have specified providing the requested information in the content structure.

The prototype system involves three types of content structure: parts taxonomies, kinds taxonomies and path algorithms. The information requested for each element of these respective content structures varies depending on the content information you have previously provided.

CONTENT STRUCTURE -- ENTITY

A course goal can be associated with several different entities. Click hold on the entity box, drag to EXPAND, the entities you have identified will be displayed.

Each of the entities you have identified can be elaborated according to either a "parts" or "kinds" content structure. ID EXPERT will automatically select the appropriate type of content structure depending on the information you have previously provided.

To complete the content analysis select a particular entity, click and drag to EXPAND. Type in the number of parts or the number of coordinate concepts. A box will appear for each part or each kind. For each part click and drag to label, function, key words, or notes to supply additional content information related to parts. OR click and drag to concept name, attributes, instances or notes to supply additional information related to kinds.

CONTENT STRUCTURE -- ACTIVITY

A course goal can be associated with several different activities. Click hold on the activity box, drag to EXPAND, the activities you have identified will be displayed.

Each of the activities you have identified can be elaborated according to a "path algorithm" content structure. ID EXPERT will automatically

select the appropriate type of content structure depending on the information you have previously provided.

To complete the content analysis select a particular activity, click and drag to EXPAND. Type in the number of steps. A box will appear for each step. For each step click and drag to name and define each step. Supply the action, object, result and consequence of each step.

CONTENT STRUCTURE -- GOAL NUMBER

This is the Goal number supplied by the system. This number is used by the system to keep track of information associated with this goal. The content structure supplied below will be associated with this goal. If you wish to specify content structure for a different goal return to the COURSE GOAL card and select the content structure at the "specification", and then select the goal you wish to consider.

If you delete a goal the numbers will be reassigned. The system will remember to keep the content structure information associated with the new goal number.

CONTENT STRUCTURE -- IDENTIFIER

This is the identifier you supplied on the COURSE GOAL card. The content structure supplied below will be associated with this goal. If you wish to provide content structure for a different goal return to the goal card and select the goal you wish to specify.

4.1.8. Content Structure: Concept Information Frame

Node demographics are the characteristics of this particular concept. Choose Define Attributes from the pop-up menu. The list of attributes defined for the superordinate concept appears. Indicate the specific value on each attribute for this concept.

Instances allows you to indicate information about instances. Matched enables you to indicate how examples of this concept are matched to instances of other concepts in the coordinate set.

When a concept represents a class or ordered set then the instances are represented by a dimension rather than by separate classes. Choose Define dimension from the pop-up menu to define the dimension along which instances vary.

Concept characteristics enable you to define the attributes of the concepts as a set. Concepts characteristics include:

- Embedded -- instances usually appear in context and the context required for classification.
- Isolated -- instances can be presented without the surrounding context.
- Abstract -- a defined concept. Concrete -- concrete instances can be directly observed.
- Few Attributes -- few defining attributes. Many attributes -- many defining attributes.
- Document -- instances best represented by written symbols.
- Illustration -- instances best represented by graphics, charts, drawings, picture.

4.1.9 Content Structure: Coordinate Set Information

The instructional objective indicates the objective for the coordinate set of concepts.

Set demographics enables you to identify the attributes by which the concepts in the coordinate set are defined and the legal values that these attributes can assume. Select Define Attributes from the pop-up menu and type in the attributes and their legal values.

Concept characteristics enable you to define the attributes of the concepts as a set.

Embedded -- instances usually appear in context and the context required for classification.

Isolated -- instances can be presented without the surrounding context.

Abstract -- a defined concept. Concrete -- concrete instances can be directly observed.

Few Attributes -- few defining attributes. Many attributes -- many defining attributes.

Document -- instances best represented by written symbols.

Illustration -- instances best represented by graphics, charts, drawings, picture.

4.1.10 Content Structure: Parts-Of Taxonomy Frame

A parts taxonomy defines the parts of an entity including their location and function. A parts content structure limits the number of parts at any level to a maximum of 7. If there are are more than 7 parts you will need to cluster these parts using some grouping name or part.

To elaborate a parts taxonomy click on the entity, drag to expand, indicate the number of parts. For each part click and drag to supply the name, function and key words corresponding to the part.

To find subparts for a given part click on the part, drag to expand, indicate the number of subparts. For each subpart click and drag to supply the name, function, and key words corresponding to the subpart. Repeat for as many levels as necessary.

4.1.11 Content Structure: Kinds-Of Taxonomy Frame

A kinds taxonomy defines the coordinate concepts of an entity when it consists of discrete categories of different concepts. A coordinate set content structure limits the number of coordinate concepts at any level to a maximum of 7. If there are are more than 7 categories you will need to cluster these categories using some more general concept.

To elaborate a kinds taxonomy click on the entity, drag to expand, indicate the number of coordinate concepts. For each coordinate concept click and drag to supply the name, attributes, and legal values for these attributes. Legal values are all the values that a given attribute can assume.

To find subordinate concepts click on the concept, drag to expand, indicate the number of subordinate categories. For each subordinate category drag to supply the name, attributes and values corresponding to the subordinate concept. Repeat.

4.1.12 Content Structure: Path Hierarchy Frame

A path algorithm defines the steps in an activity. A path algorithm structure limits the number of steps at any level to a maximum of 7. If there are are more than 7 steps you will need to cluster these steps using some more general step.

To elaborate a path algorithm click on the activity, drag to expand, indicate the number of steps. For each step click and drag to supply the name, action and object, result and consequence of the action.

To find subteps for a given step click on the step, drag to expand, indicate the number of substeps. For each substep click and drag to supply the name, action and object, result and consequence of the step. Repeat as necessary

4.1.13 Course Organization Frame

ID EXPERT uses the information you've provided to recommend a course organization. This flow chart indicates control structures (menus/or decisions indicated by diamonds), integrative modules (preintegrative and postintegrative indicated by rounded rectangles), maps consisting of more detailed course organization nested within a higher level of organization (indicated by shadowed rectangles) and instructional modules (indicated by rectangles).

Control structures (diamonds) indicate that the student or the system will make a choice of the next module or map (set of modules) that a given student should study. [The prototype version of ID EXPERT has not yet implemented prescriptions for course level control structures.]

Integrative modules (rounded rectangles) indicate overviews, pretests, posttests and other instructional transactions which integrate the content from several modules. [The prototype version of ID EXPERT has not yet implemented detailed prescriptions for integrative modules.]

Maps (shadowed rectangles) indicate that a set of modules are nested within the course organization at this point. There can be as many levels of nesting as are necessary to provide the necessary instructional modules to teach the content specified by the content

structure. You can see the nested course organization by selecting Expand from the pop-up menu associated with a map rectangle.

Instructional modules (rectangles) indicate a unit of instruction which will teach a given set of content information. You can drag to the pop-up menu associated with each module to get a list of the content topics included in the module or to get the instructional objective associated with the module. Each module is also associated with a transaction strategy consisting of a set of individual interactions with the student. ID EXPERT uses its reasoning capabilities to recommend a transaction strategy for each module. (See Transaction Strategy products). You can see the transaction strategy recommended for a given module by selecting Transactions from the pop-up menu associated with each module.

4.1.14 Transaction Strategy Frames

For each module ID EXPERT recommends a transaction strategy appropriate for the students and content to be taught. A transaction strategy consists of an overview interaction (rounded rectangles), control structures (diamonds), and different types of interactions or transactions with the student (rectangles).

ID EXPERT indicates whether or not a control structure decision is learner controlled or system controlled (based on some criterion). The overview transaction is designed to preview the content of the module for the student. Each transaction in the transaction strategy is associated with a detailed display strategy and a transaction shell. Select "Demo the Transaction" from the pop-up menu to see a demonstration.

Future versions of ID EXPERT will take the content information you have provided and guide you in providing any additional information necessary to instantiate each transaction for your content material. [This authoring capability has not yet been implemented for the prototype system]

The control structures consist of menus or system decisions which determine which interaction the student engages in next. ID EXPERT indicates whether or not the decision is learner controlled or system controlled (based on some criterion). [The prototype system does not yet specify detailed control structures.]

4.2 User Interface

ID Expert is a frame based system. Each step in the process is driven by a Hypercard frame that has associated slots for placing information, and logic that functions as a mini-expert for the consultation relevant to that frame.

Selection of frame, and in general the order for entering information into frames is under user control. The user may type directly into some slots, or access a pop-up menu which displays the valid possibilities for that slot. In addition, there is a menu bar at the top of the screen for navigation to other frames.

In this section, the screen images associated with the primary knowledge acquisition frames are presented. Of the number of possible transaction strategy frames, one is shown as an example Additionally, the valid input for each frame, and means of entry are discussed.

On any informational frame you can see definitions of technical terms by clicking on the term. Pop-up information will appear.

On any informational frame you can get additional information by selecting Help from the Option menu.

Menu bar menus, available throughout the consultation, contain the following items:

File menu:
- New Course
- Open Course...
- Save a copy...
- Quit ID Expert

Option menu
- Introduction
- Expert Consultation
- Using ID Expert
- Help

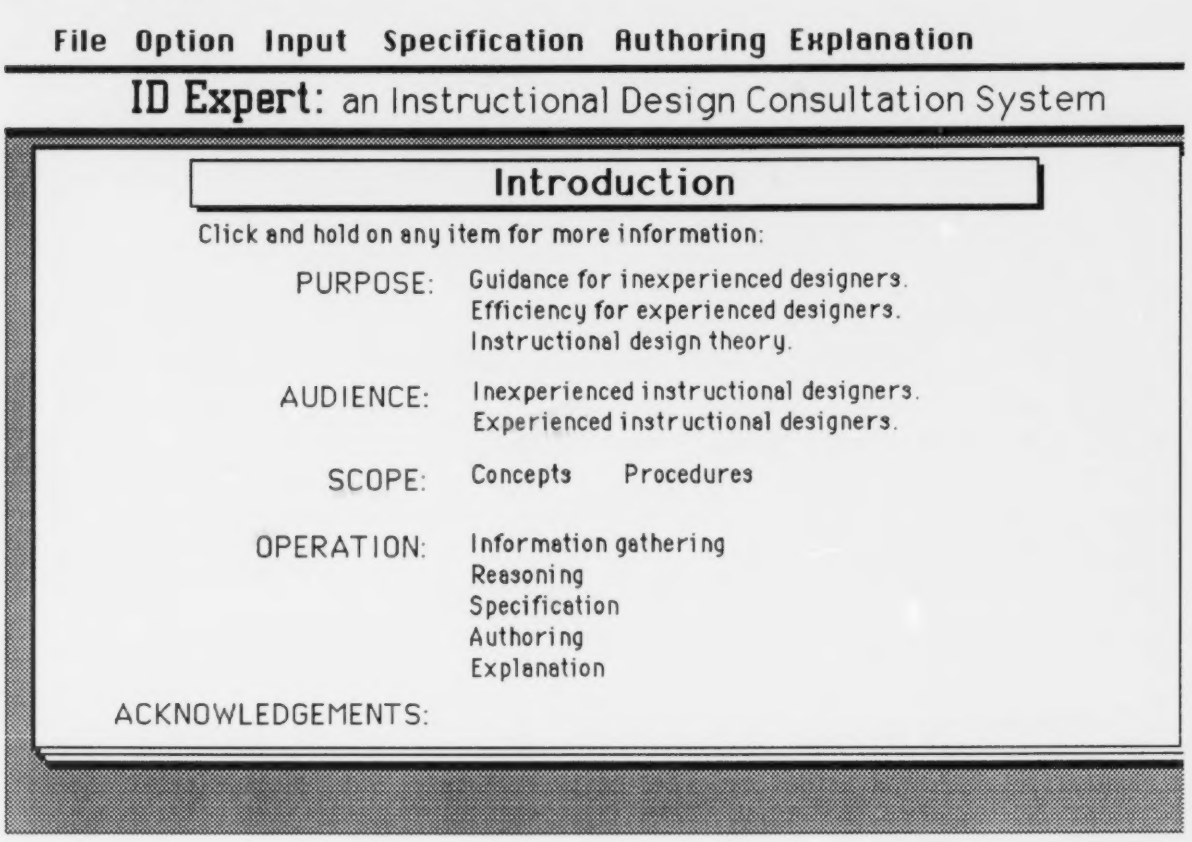
Input menu
- Course Information
- Student Characteristics
- Content Information
- Environment Information

Specification menu

Content Structure
Course Organization
Transactions
Authoring menu
Demo the Transaction
Design the Transaction
Make Run-Time
Explanation menu
Rules
Related References
Related Guidelines
References
Guidelines

Not all menu items are available at any given time. Those not available are dimmed. Not all menu items are implemented for phase 3. Those not implemented are also dimmed.

4.2.1 Introduction Frame



GETTING STARTED

NEW COURSE

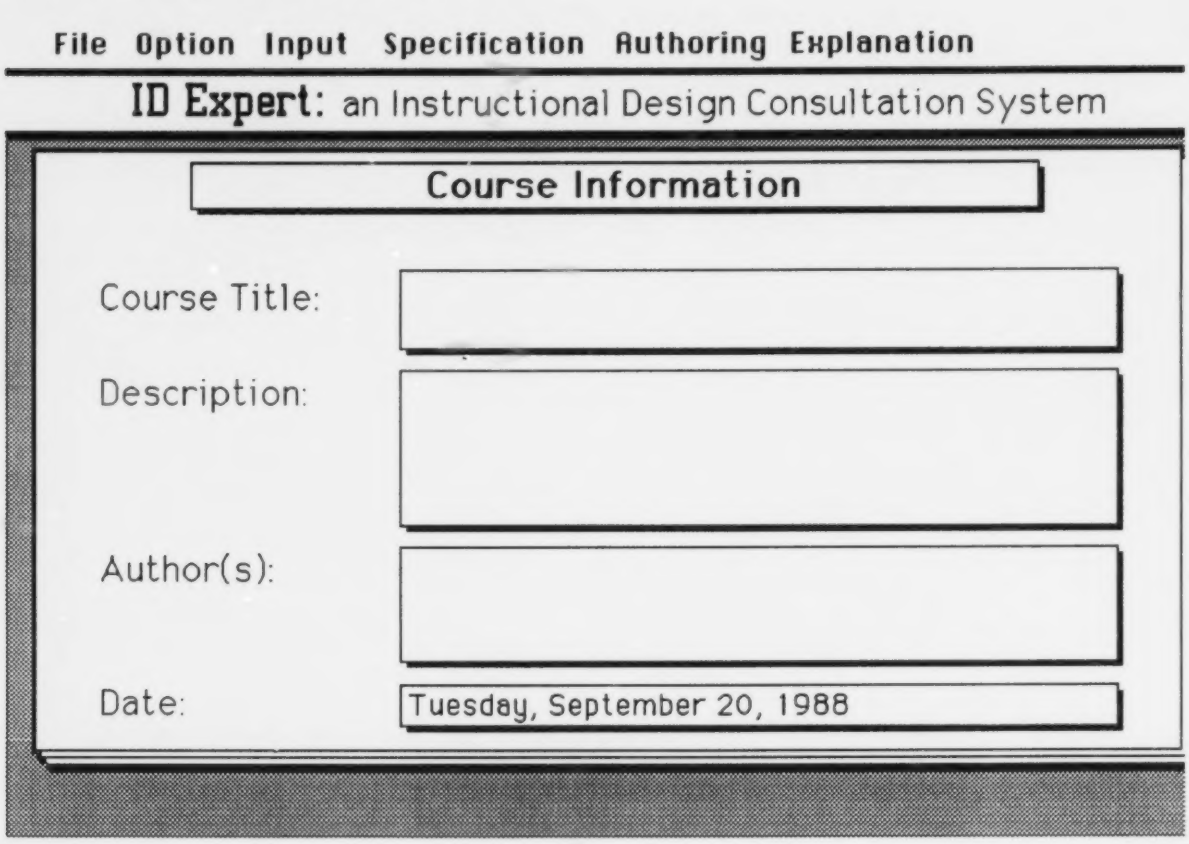
- From File menu select New Course
- Type course name in box "new stack name"
- Click new
- Click cancel if you change your mind
- Do not change any other items in dialog

EXISTING COURSE

- From File menu select Open Course
- Select course name from menu
- Click Open
- Click Cancel if you change your mind.

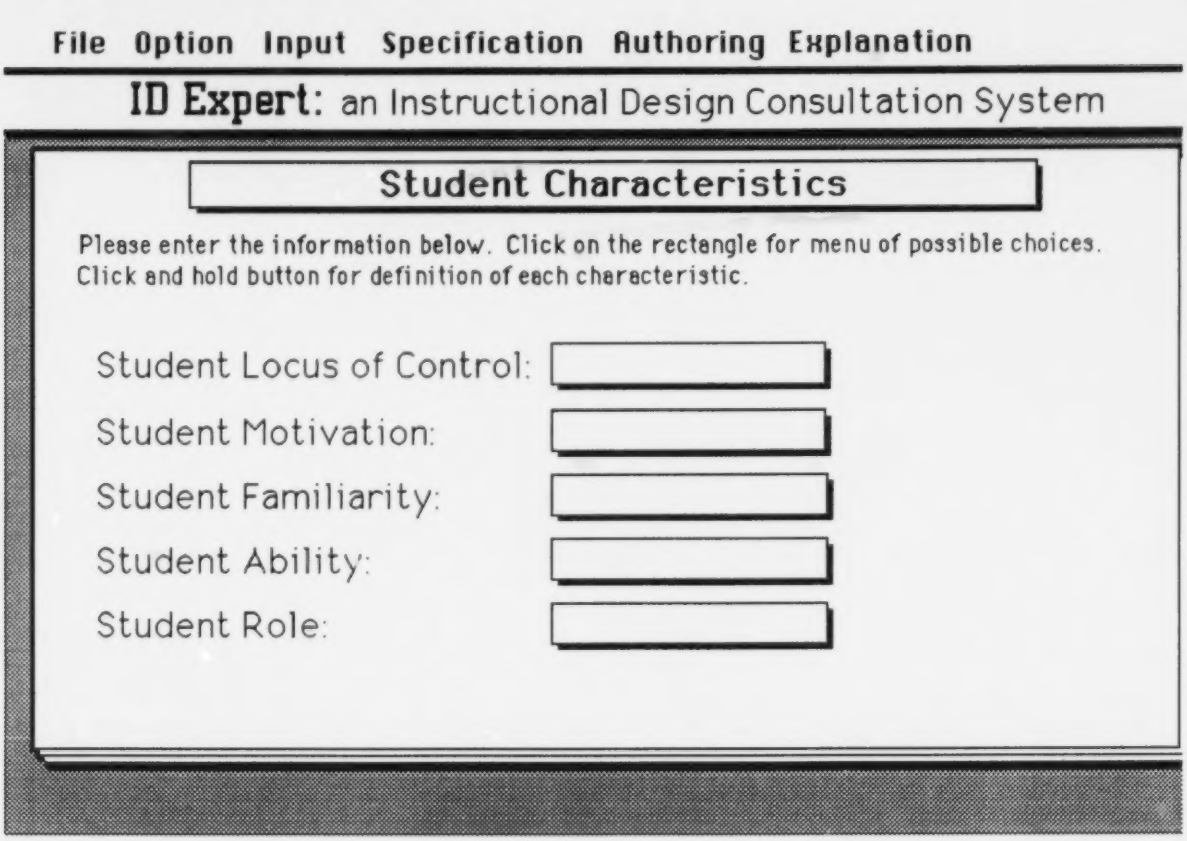
- Course information previously supplied will appear in course information box.

4.2.2 Course Information Frame



- Complete Course Information Card
  - Type:
  - Course title
  - Description
  - Author(s)
  - Date

4.2.3 Student Characteristics Frame


File Option Input Specification Authoring Explanation
ID Expert: an Instructional Design Consultation System
Student Characteristics
Please enter the information below. Click on the rectangle for menu of possible choices.
Click and hold button for definition of each characteristic.
Student Locus of Control:
Student Motivation:
Student Familiarity:
Student Ability:
Student Role:

- Input menu select Student Characteristics.
- Audience Characteristics card appears.
- Provide values for each characteristic.
- Click and hold on value box.
- Drag to value on pop-up menu.

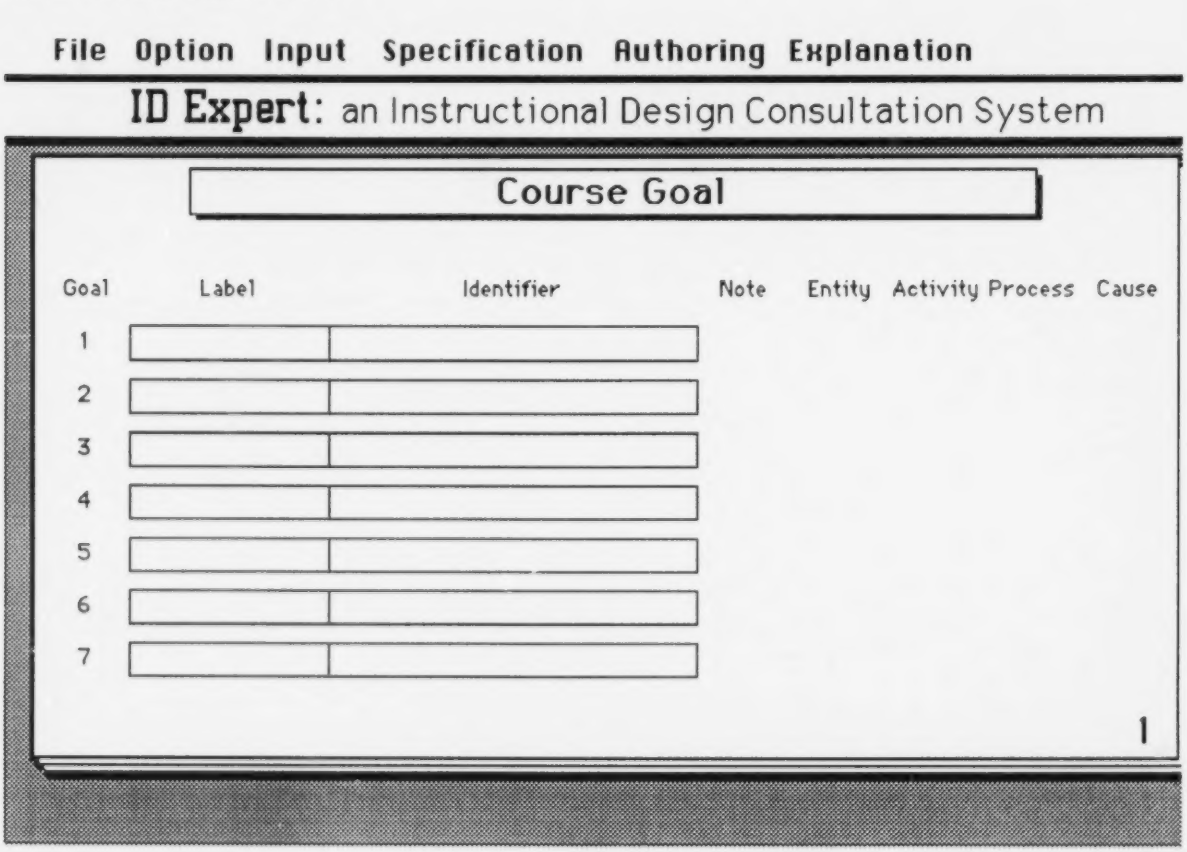
Popup menus are as follows:

for locus of control:
    internal
    external
for motivation, familiarity, and ability
    high

moderate
low
for role
consumer
supervisor
technician
problem solver

- Drag to help for value definitions.
- Drag to Prescribe for recommendations.
- NOTE: Prescribe usually requests additional information, invokes the reasoning capabilities of ID EXPERT and makes a recommendation for the value. [Implemented only for motivation in the prototype.]

4.2.4 Course Goal Frame



- Input menu select Content Information.
- Goal Card will appear.
- You can define as many goals as you want.
- Each goal must include:
  - label
  - identifier
  - at least one entity.
- Each goal may also include:
  - one or more activities
  - one or more processes [not implemented]
  - one or more causes [not yet implemented]

TO DEFINE A GOAL

- Click and hold on label or identifier box.

Popup menu appears, with items:

Add Goal
Delete Goal
Change Label
Change Identification

- Drag to Add Goal.
- Enter goal label.
- Enter goal identifier.
- Click and hold on label or identifier box.
- Drag to Delete a goal.
- Drag to modify Label or Identifier.

Optional:

- Click and hold on note box.
- Drag to Add, Change or Erase.
- Enter any commentary about your goal.

TO DEFINE ENTITY FOR GOAL

- Click Entity box corresponding to goal.
- Course Goal Entity card appears.
- Each goal can have up to 7 entities.
- Click on return arrow (lower right) to return to Course Goal card.

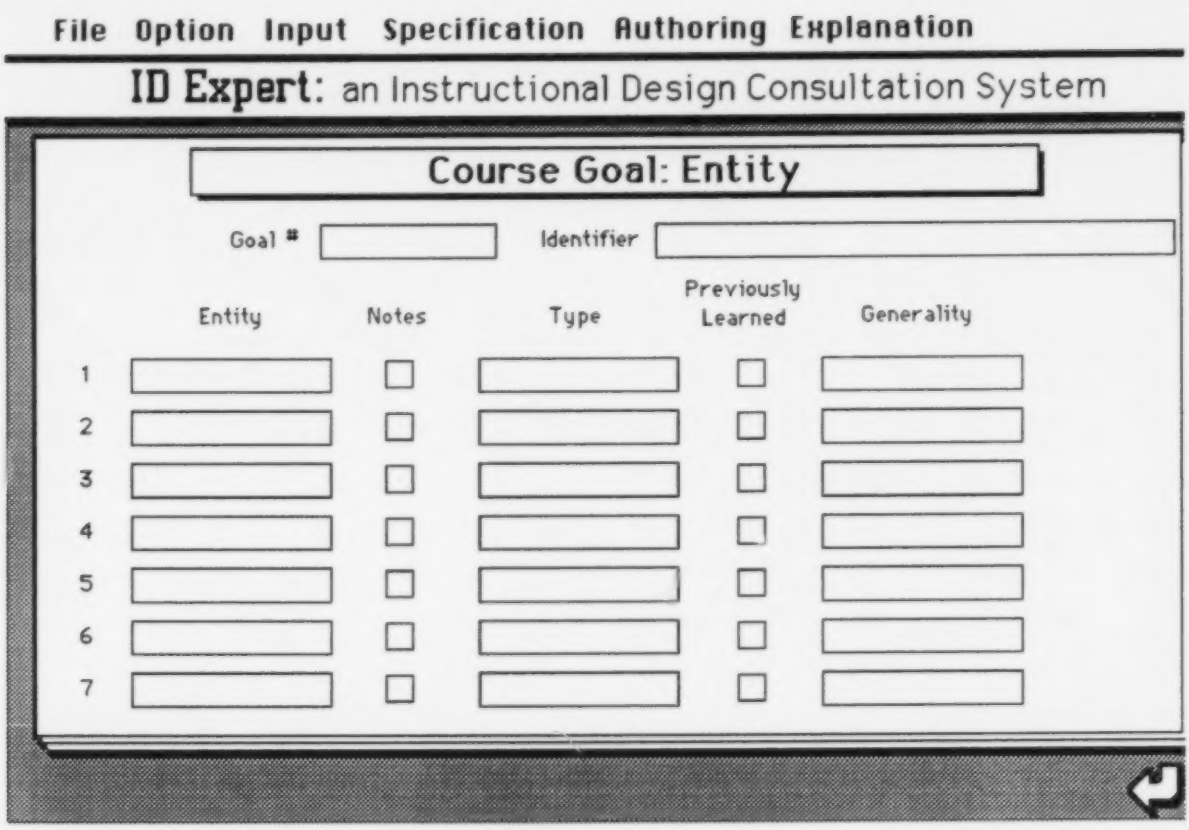
TO DEFINE ACTIVITY FOR A GOAL

- Click and hold on Activity box for goal.

  Popup menu appears with items:
  Add Activity
  Change Activity
  Erase Activity

- Drag to Add Activity or Change Activity.
- Course Goal Activity card appears.
- Each goal can have up to 7 activities.
- Click on return arrow (lower right) to return to Course Goal card.

4.2.5 Entity Frame



- Click Entity box corresponding to goal.
- Course Goal Entity card appears.
- Each goal can have up to 7 entities.
- Each entity must have:
  - name
  - type
  - level of generality.
- Click and hold on entity name box.

  Pop up menu appears with items:
  Add Entity
  Change Entity

Delete Entity

- Drag to Add entity - enter entity name.
- Click and hold on entity name box.
- Drag to Change an entity.
- Drag to Delete an entity.

Optional:

- Click and hold on note box.
- Drag to Add, Change or Erase.
- Enter any commentary about your goal.
- Click and hold on Type value box.
- Drag to value for Type.

Values in the popup menu are:
Device/Object
Event
Person
Symbols
Place
Help
Prescribe

- Drag to Help for value definitions.
- Drag to Prescribe for recommendations.
- [Not yet implemented for prototype].

Conditional:

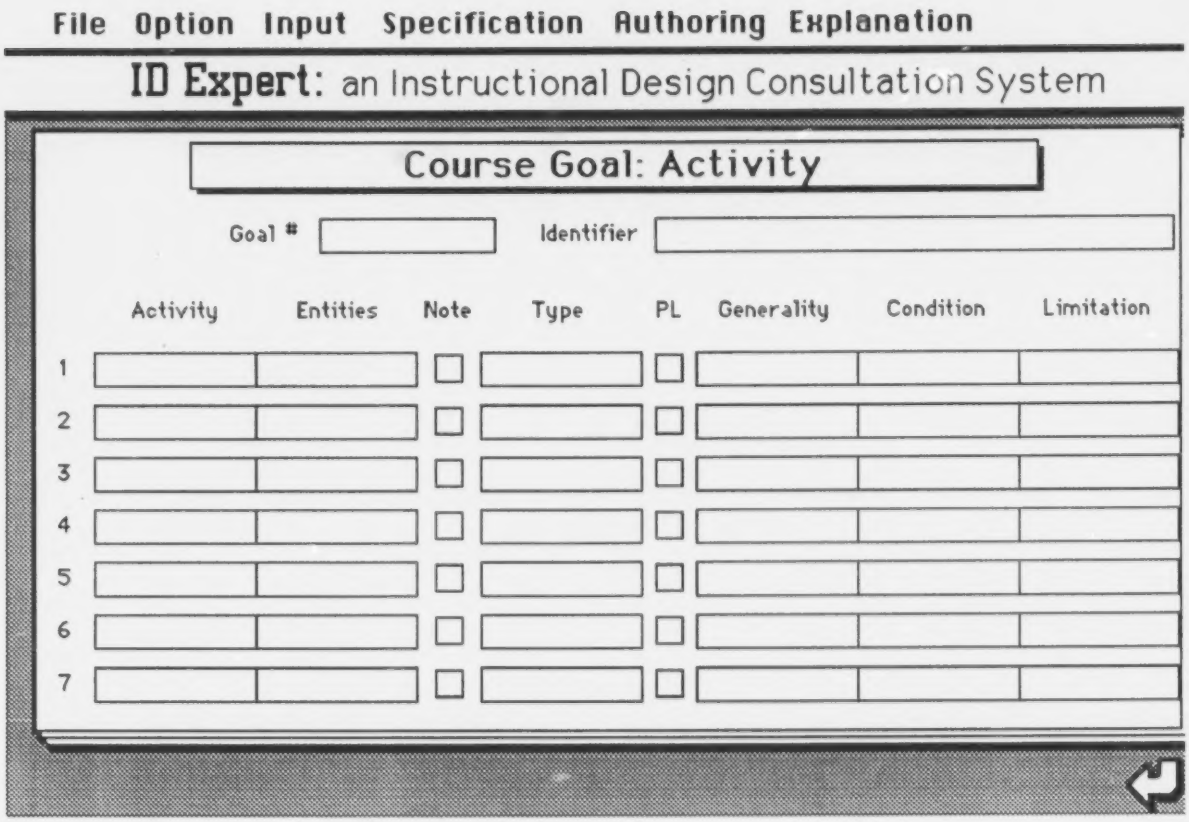
- Click on Previously Learned box
- IF entity is already known by learner.
- Your goal may include entities which have been previously learned by the learners and which you wish to exclude from detailed analysis and instruction.

- Click and hold on Generality value box.
- Drag to level of generality.

  Generality levels in the pop up menu are:
  - Specific
  - Class
  - Discrete Set
  - Ordered Set
  - Generalize
  - Help
  - Prescribe

- Drag to Help for value definitions.
- Drag to Prescribe for recommendation.
- [Not yet implemented for prototype].
- Click on return arrow (lower right) to return to Course Goal card.

4.2.6 Activity Frame



- Click and hold on Activity box for goal.
- Drag to Add Activity or Change Activity.
- Course Goal Activity card appears.
- Each goal can have up to 7 activities.
- Each activity must have
  - name
  - associated entity
  - type
  - level of generality
  - conditional state
  - performance limitations.

- Click and hold on activity name box

  Popup menu appears with items:
  - Add Activity
  - Change Activity
  - Delete Activity

- Drag to Add activity -- enter activity name.
- Click and hold on activity name box
- Drag to Change or review activity.
- Drag to Delete an activity.
- Click and hold on associated Entities box
- Drag to select associated entity.
- Only entities previously defined are listed.
- You must define entities before defining activities.

Optional:

- Click and hold on note box to Add, Change or Erase comments.
- Click and hold on Type value box.
- Drag to value for Type.
- Note: options listed are contingent on type of entity.

  Options in pop up menu for a device/object entity are:
  - Operate
  - Assemble
  - Troubleshoot
  - Help
  - Prescribe

- Drag to Help for definitions of values.
- Drag to Prescribe for recommendations.
- [Not yet implemented for prototype].

Conditional:

- Click on PL box
- IF activity is already known by learners.
- Your goal may include activities which have previously been learned by the students and which you wish to exclude from detailed analysis and instruction.
- Click on Generality value box.
- Drag to value for generality.

  Values for generality in popup menu are:
  Specific
  Class
  Discrete Set
  Ordered Set
  Generalize
  Help
  Prescribe

- Drag to Help for value definitions.
- Drag to Prescribe for recommendations.
- [Not yet implemented for prototype].
- Click on Condition box.
- Drag to value for condition.

  Values for condition in the popup menu are:
  Invariable
  Conditional
  Help
  Prescribe

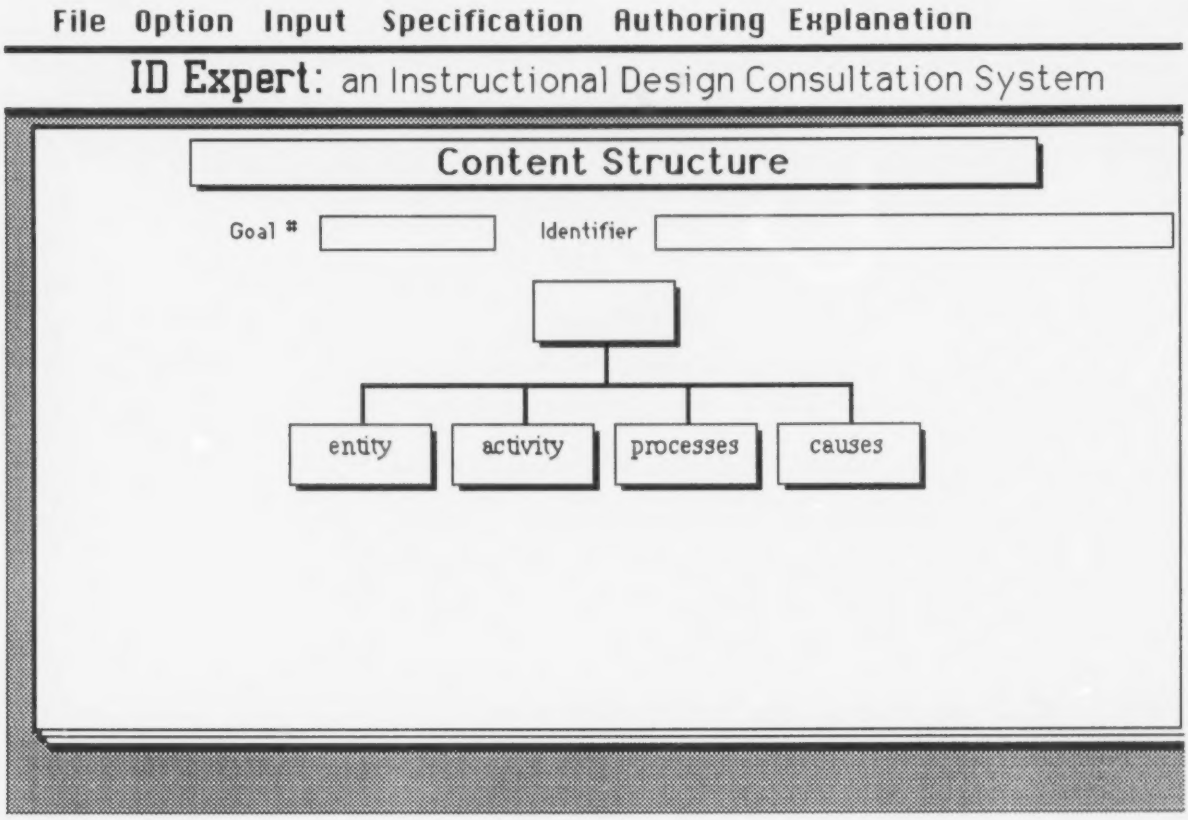
- Drag to Help for value definitions.
- Drag to Prescribe for recommendations.
- [Not yet implemented for prototype].

- Click on Limitation box.
- Drag to value for limitation.

  Values in the popup menu for limitation are:
  Instruction
  On Job
  Help
  Prescribe

- Drag to Help for value definitions.
- Drag to Prescribe for recommendations.
- [Not yet implemented for prototype].
- Click on return arrow (lower right) to return to Course Goal card.

4.2.7 Content Structure Frame



Content analysis guidance is determined by the content information you have supplied. You must first define at least one goal with an associated entity and, if necessary, activity before ID EXPERT can guide your content analysis activities.

- You must first GO TO the Course Goal Card.
- Input menu select Content Information.
- From specification menu select Content Structure.
- Select desired goal from menu.
- Note: There is a separate content structure associated with each goal.
- Content Structure card appears.

NOTE:

Depending on the content information you have provided ID EXPERT selects an appropriate content analysis procedure. You will be guided by one of the following procedures. You do not need to select the appropriate procedure it will automatically be selected by ID EXPERT contingent on the information you have previously supplied.

PARTS OF ANALYSIS FOR ENTITIES

- Click and hold on Entities box.

  Popup menu appears with items:
  Expand
  Collapse
  Help

- Drag to Expand.
- The entities you have defined will appear.
- Click on a particular entity.

  Pop up menu appears with items:
  Sub-Parts
  Parameters
  Notes

- Drag to Sub-Parts.
- Type the number of parts.
- A box appears for each part.

REPEAT for each part.

- Click and hold on the box.
- Drag to Label -- type the label.
- Drag to Function -- type the function.
- [Not yet implemented]
- Drag to Key Words -- type key words.
- [Not yet implemented]
- Drag to notes -- type commentary.
- [Not yet implemented]

FOR further ELABORATION

- Drag to SubParts -- repeat above step

To RETURN to higher level of content structure.

- Drag to Collapse.

To DELETE this part and subparts.

- Drag to Delete.

DISCRETE SET ANALYSIS FOR ENTITIES

- Click and hold on Entities box.
- Drag to Expand.
- The entities you have defined will appear.
- Click on a particular entity.

- Drag to Expand.
- Type the number coordinate concepts.
- Type list of attributes.
- Type legal values for each attribute.
- A box appears for each kind.

REPEAT for each kind.

- Click and hold on the box.
- Drag to Concept Name -- type the name.
- Drag to Attribute -- select value for each attribute.
- [Not yet implemented]
- Drag to Instances -- type identification for each instance.
- [Not yet implemented]
- Drag to notes -- type commentary.
- [Not yet implemented]

FOR further ELABORATION

- Drag to Subordinate -- repeat above step

To RETURN to higher level of content structure.

- Drag to Collapse.

To DELETE this and subordinate concepts.

- Drag to Delete.

CLASS ANALYSIS FOR ENTITIES

To be defined

GENERALIZE ANALYSIS FOR ENTITIES

To be defined

ORDERED SET ANALYSIS FOR ENTITIES

To be defined

PATHS ANALYSIS FOR ACTIVITIES.

- Click and hold on Activities box.
- Drag to Expand.
- The activities you have defined will appear.
- Click on a particular activity.
- Drag to Expand.
- Type the number of steps.
- A box appears for each step.

REPEAT for each step.

- Click and hold on the box.
- Drag to Label -- type the label.
- Drag to Define Step -- type the action, object, result and consequence.
- [Not yet implemented]
- Drag to notes -- type commentary.
- [Not yet implemented]

FOR further ELABORATION

- Drag to SubSteps -- repeat above step

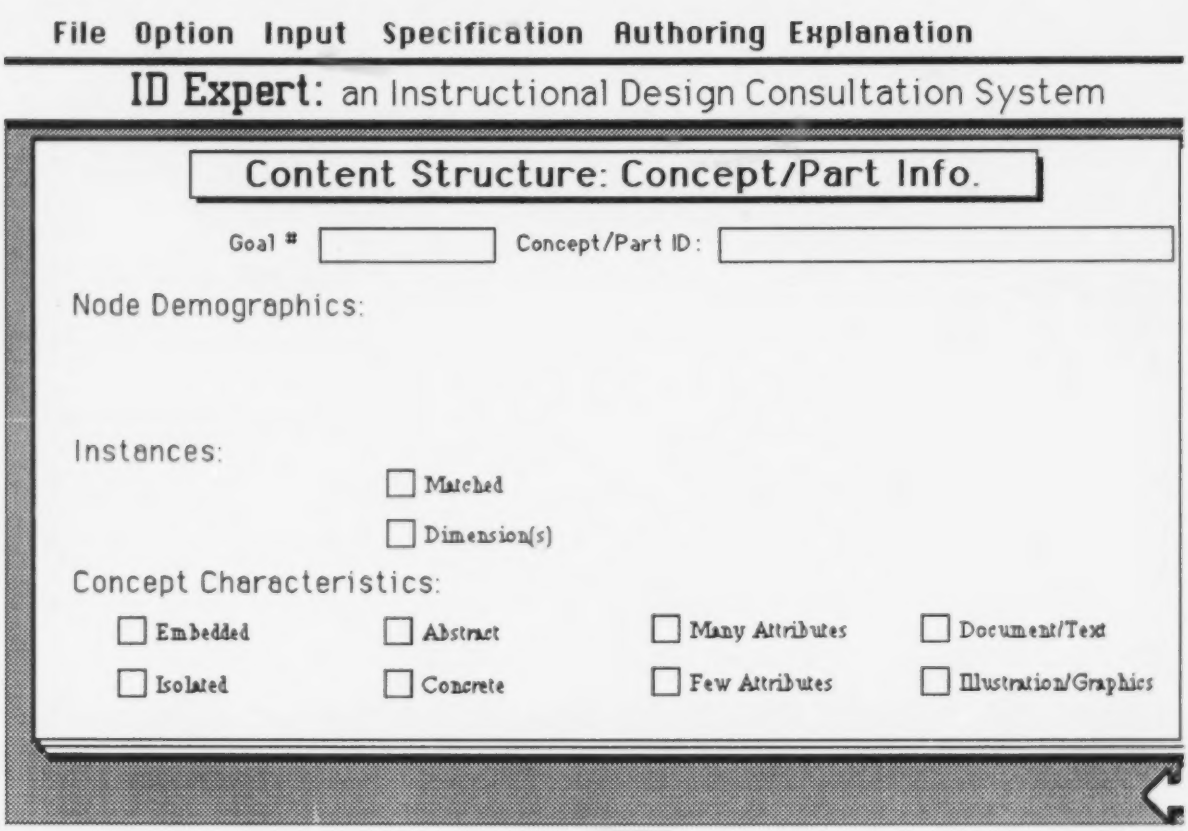
To RETURN to higher level of content structure.

- Drag to Collapse.

To DELETE this step and substeps.

- Drag to Delete.

4.2.8 Concept Information Frame



Node demographics are the characteristics of this particular concept. Choose Define Attributes from the pop-up menu. The list of attributes defined for the superordinate concept appears. Indicate the specific value on each attribute for this concept.

Instances allows you to indicate information about instances. Matched enables you to indicate how examples of this concept are matched to instances of other concepts in the coordinate set.

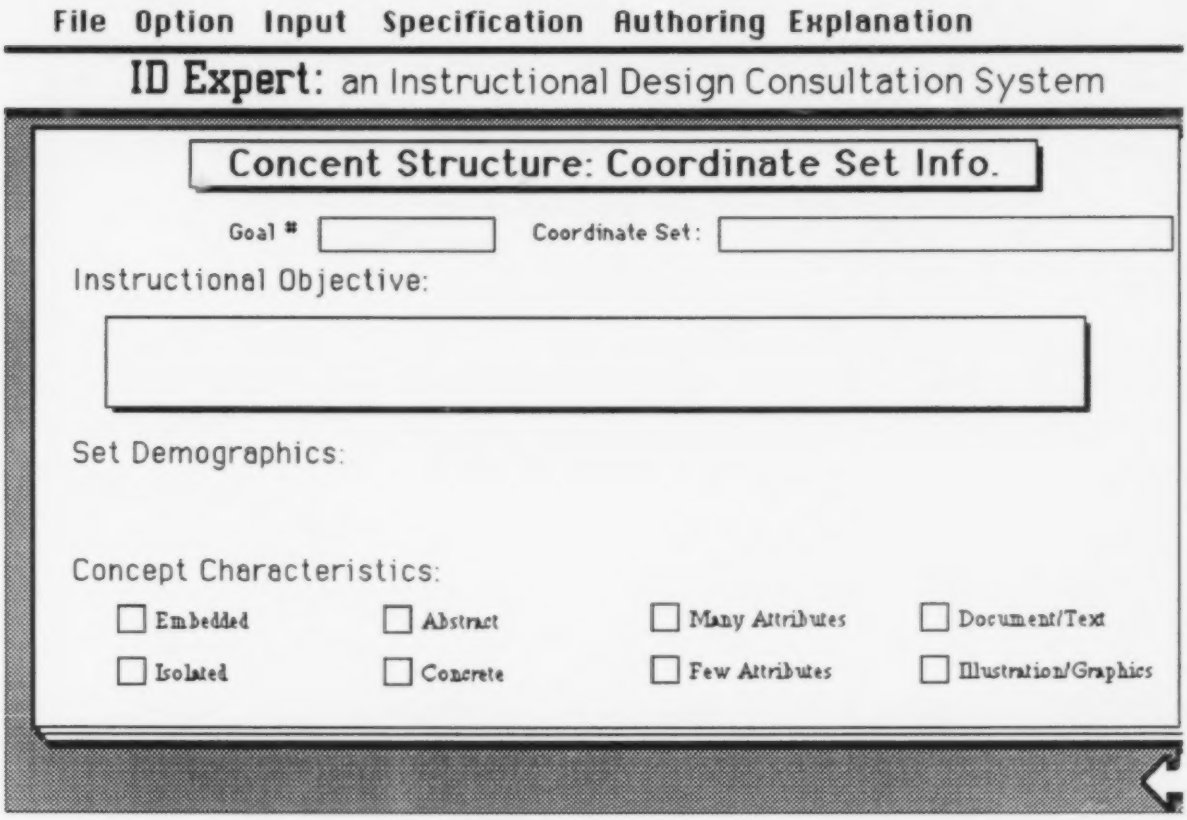
When a concept represents a class or ordered set then the instances are represented by a dimension rather than by separate classes.

Choose Define dimension from the pop-up menu to define the dimension along which instances vary.

Concept characteristics enable you to define the attributes of the concepts as a set. Concepts characteristics include:

- Embedded -- instances usually appear in context and the context required for classification.
- Isolated -- instances can be presented without the surrounding context.
- Abstract -- a defined concept. Concrete -- concrete instances can be directly observed.
- Few Attributes -- few defining attributes. Many attributes -- many defining attributes.
- Document -- instances best represented by written symbols.
- Illustration -- instances best represented by graphics, charts, drawings, picture.

4.2.9 Coordinate Set Information Frame



Set demographics enables you to identify the attributes by which the concepts in the coordinate set are defined and the legal values that these attributes can assume. Select Define Attributes from the pop-up menu and type in the attributes and their legal values.

Concept characteristics enable you to define the attributes of the concepts as a set.

Embedded -- instances usually appear in context and the context required for classification.

Isolated -- instances can be presented without the surrounding context.

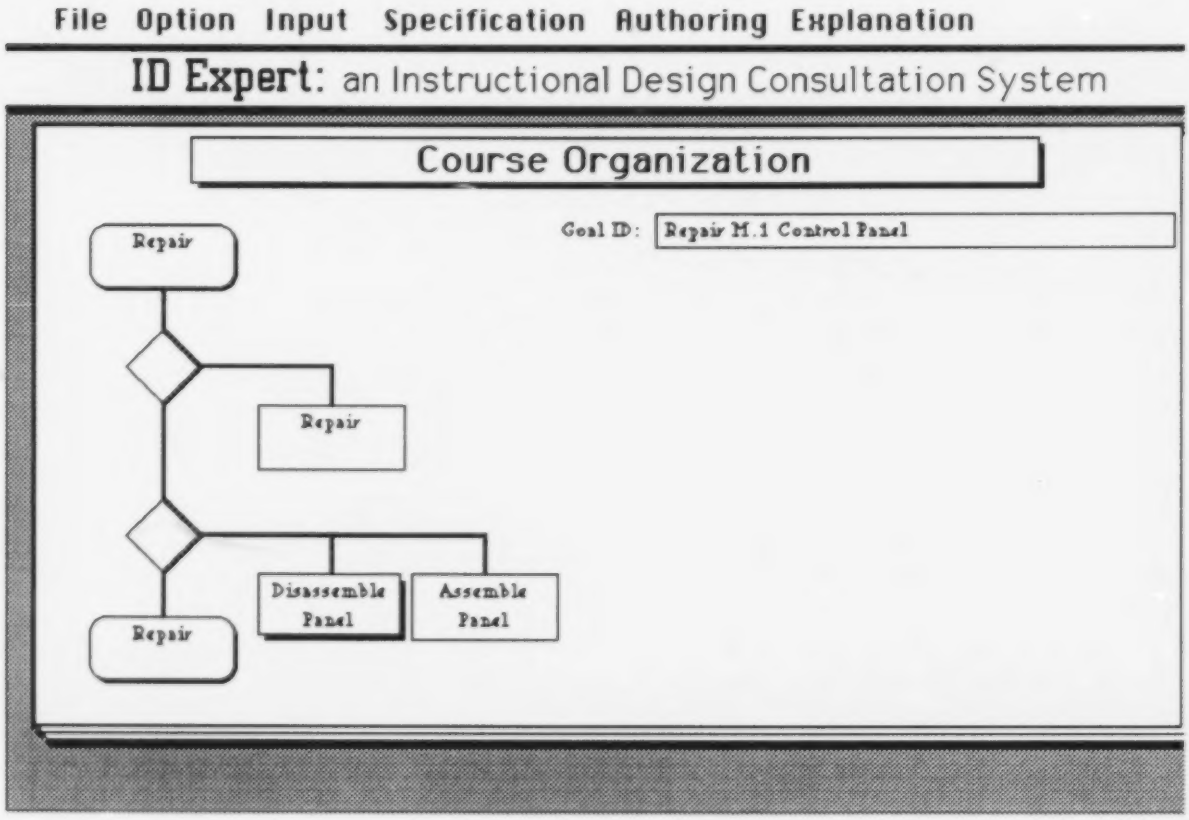
Abstract -- a defined concept. Concrete -- concrete instances can be directly observed.

Few Attributes -- few defining attributes. Many attributes -- many defining attributes.

Document -- instances best represented by written symbols.

Illustration -- instances best represented by graphics, charts, drawings, picture.

4.2.10 Course Organization Frame



[Note: because the course organization frame is blank until a content structure has been defined, this card is taken from an example course.]

Course Organization and Transactions are determined by the information you have provided for audience characteristics, environment and content information. These recommendations are also determined by the content structure you provided by your

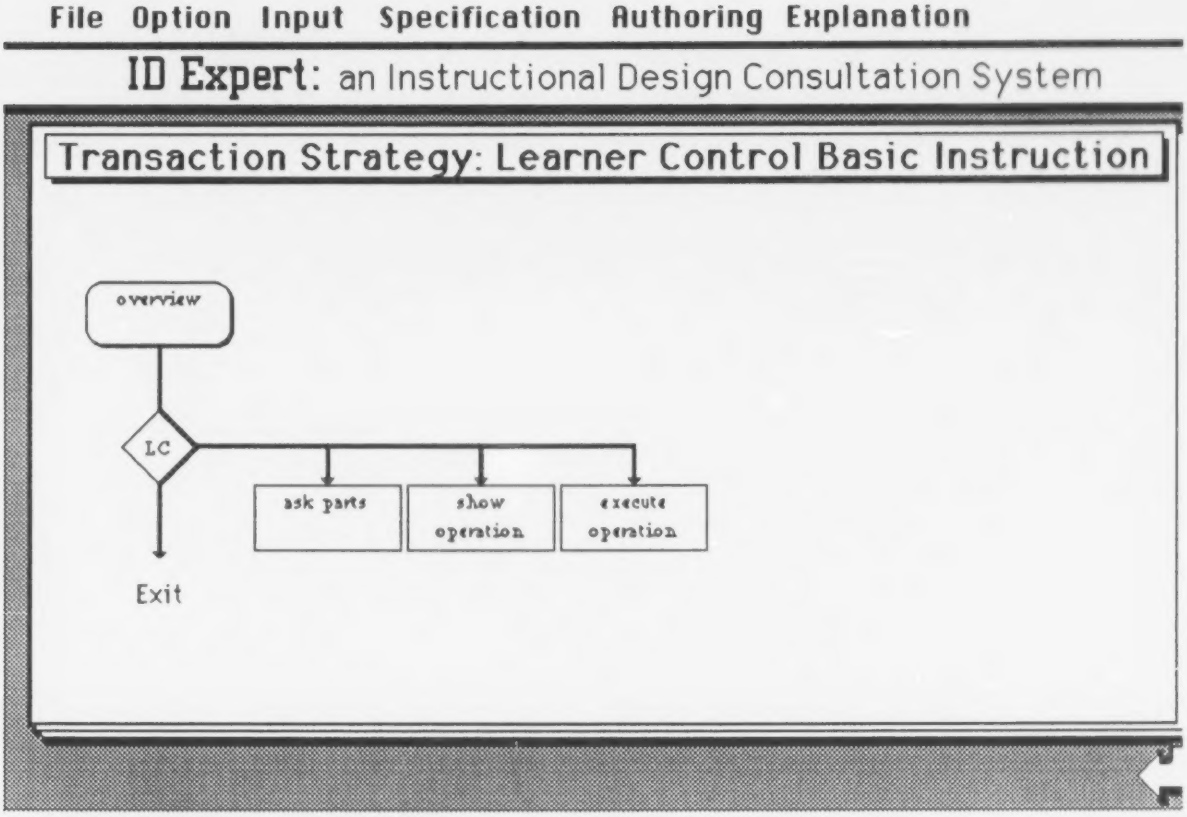
content analysis. Before ID EXPERT can recommend Course Organization and Transactions you must have completed your content analysis for at least one entity.

- GO TO the elaborated Content Structure for an entity or activity for a particular goal.
- From the input menu select Content Information
- Course Goals card will appear.
- From the specification menu select Content Structure.
- Content Structure card will appear.
- Click and hold on entity or activity.
- Drag to Expand.
- Entities or activities will appear.
- Click and hold drag to Expand for particular entity or activity.
- Elaborated content structure for entity or activity will appear.
- From the specification menu select Course Organization.
- Course Organization card will appear.
- Each box represents a module.
- Click and drag to Content to see list of content items included in the module.
- Click and drag to Objective to see the objective for the module.

IF the box is shadowed it represents a more detailed course organization nested within the organization shown.

- Click and drag to Subordinate.
- More detailed Course Organization will appear.
- Click and drag to Superordinate.
- Higher level course organization reappears.

4.2.11 Transaction Strategy Frame



- Click and hold on module box.
- Drag to Transaction.
- Transaction Strategy card appears.

Or

- From specification menu select Transaction.
- Module menu appears.
- Select module you want to consider.
- Transaction Strategy card appears.
- Note: If ID EXPERT has not previously selected a transaction strategy then a message will request that you select Expert

Consultation from the Option menu. ID EXPERT will invoke its reasoning capabilities to recommend a transaction strategy.

Transaction demonstrations and authoring can only be invoked from the Transaction Strategy card. It is necessary for ID EXPERT to have already recommended a transaction strategy in order for the system to select a transaction for demonstration or authoring.

- To GO TO Transaction Strategy Card:
- Input menu select Content Information
- Course Goals card will appear.
- From the specification menu select Content Structure.
- Content Structure card will appear.
- Click and hold on entity or activity.
- Drag to Expand.
- Entities or activities will appear.
- Click and hold drag to Expand for particular entity or activity.
- Elaborated content structure for entity or activity will appear.
- From the specification menu select Course Organization.
- Course Organization card appears.
- Click and hold on desired transaction box.
- Drag to Transaction Demonstration on pop-up menu.
- You will be shown a demonstration of the transaction.

Or

- from the authoring Menu select Demo the Transaction.
- Select the desired transaction from the transaction menu.
- You will be shown a demonstration of the transaction.

Note: Not all transaction shells have been implemented. A message will indicate if a particular transaction has not yet been implemented.

DISPLAY STRATEGIES

ID EXPERT includes a library of transaction shells which will enable the system to take the information provided for content information and during content analysis. ID Expert will guide you to provide any additional necessary for delivery of the instruction and will package this material for presentation to the student using an appropirate set of display strategies (transaction.)

The authoring system has not yet been implemented for the prototype system but the prototype system does allow the user to see a demonstration of the transaction shells included in the system.

From the transaction strategy card the user selects Demonstrate Transaction from the pop-up menu associated with each transaction.

4.3 Inferencing

As earlier discussed, most of the reasoning in ID Expert has been distributed among the frames. In two areas of the prototype, Motivation and Transaction Strategy, small rule-based systems are used.

These rules were developed under Nexpert Object (Neuron Data, Inc.) expert system shell. They are then translated into HyperTalk language for effiency of execution. In the prototype, interfaces to both the Nexpert and the Hypercard implementations are maintained.

4.3.1 Student Motivation Level

This consultation determines the students' motivation toward learning. The consultation begins by asking a series of questions of the user to determine the value of variables used by the rule set. The variables, their range of permissible values, the questions asked of the user, and the answers accepted are as follows:

Volunteer (yes, no):

Why will the student take this instruction?

Students will have chosen to take this instruction.
Students will be required to take this instruction.

Promotion (yes, no):

Will this instruction contribute to a job promotion for the student?

The instruction will contribute to a job promotion for the student.
The instruction will not directly contribute to a job promotion for the student.

Raise (yes, no):

Will this instruction contribute to a pay raise for the student?

The instruction will make the student elibible for a pay increase.
The instruction will not contribute directly to a pay increase for the student.

JobChange (yes, no):

Will this instruction enable or require a job change for the student?

The instruction will enable or require a job change for the student.
The instruction will not directly contribute to any change in job for the student.

JobRequest (yes, no request, no):

Did the student request a job change which requires this instruction?

The student requested the job change which requires this instruction.
The student has not made a specific request for a job change.
The student has requested not to change to the job for which this instruction is required.

The rules for determining motivation level are as follows:

Rule #1

```
if jobChange is "yes"
and jobRequest is "yes"
then put high into motivation
```

Rule #2

```
if volunteer is "yes"
and jobChange is "yes"
and jobRequest is "yes"
then put high into motivation
```

Rule #3

```
if volunteer is "yes"
and jobChange is "yes"
and jobRequest is "no"
then put high into motivation
```

Rule #4

```
if volunteer is "yes"
and promotion is "no"
and raise is "yes"
and jobChange is "no"
then put high into motivation
```

Rule #5

```
if volunteer is "no"
and promotion is "yes"
and jobChange is "yes"
and jobRequest is "NoRequest"
then put high into motivation
```

Rule #6

```
if volunteer is "no"
and promotion is "yes"
and jobChange is "yes"
and jobRequest is "No"
then put moderate into motivation
```

Rule #7

```
if volunteer is "no"
and promotion is "yes"
and raise is "yes"
and jobChange is "no"
then put high into motivation
```

Rule #8

```
if volunteer is "no"
and promotion is "yes"
and raise is "no"
and jobChange is "no"
then put moderate into motivation
```

Rule #9

```
if volunteer is "no"
and promotion is "no"
and raise is "yes"
and jobChange is "yes"
and jobRequest is "NoRequest"
then put high into motivation
```

Rule #10

```
if volunteer is "no"
and promotion is "no"
and raise is "yes"
and jobChange is "yes"
and jobRequest is "No"
then put moderate into motivation
```

Rule #11

```
if volunteer is "no"
and promotion is "no"
and raise is "no"
and jobChange is "yes"
and jobRequest is "No"
then put low into motivation
```

Rule #12

```
if volunteer is "no"
```

```
and promotion is "no"
and raise is "no"
and jobChange is "yes"
and jobRequest is "NoRequest"
then put moderate into motivation
```

Rule #13

```
if volunteer is "no"
and promotion is "no"
and raise is "yes"
and jobChange is "yes"
then put moderate into motivation
```

Rule #14

```
if volunteer is "no"
and promotion is "no"
and raise is "no"
and jobChange is "no"
then put low into motivation
```

Rule #15

```
if volunteer is "yes"
and promotion is "no"
and raise is "no"
and jobChange is "no"
then put high into motivation
```

Rule #16

```
if volunteer is "yes"
and promotion is "yes"
and raise is "yes"
and jobChange is "yes"
and jobRequest is "No"
then put high into motivation
```

RESULT OF EXPERT CONSULTATION

Based on the information provided student motivation seems to be:

(high, moderate, low)

4.3.2 Transaction strategy knowledge base

This consultation recommends a transaction strategy for each content structure. The consultation begins by asking a single question of the user. The remainder of the variables used in the consultation are already known to the system. The variables, their range of permissible values, the question asked of the user, and the answers accepted are as follows:

Familiarity (high, moderate, low):

How familiar are the students with <content structure>?

> The student has already studied the material to be presented. The purpose of the instruction is to refresh the student's skills.
> The student may have studied similar material and is thus moderately familiar with the content.
> The material may be completely new to the student.

Degree of learning (high, low):

```
if role is "technician" or role is "problem_solver"
then put "high" into degree_of_learning
else put "low" into degree_of_learning
```

The rules for determining transaction strategy are as follows:

rule #1

```
if degree_of_learning is "low"
and motivation is "low"
then put "FI" into transaction
```

rule #2

```
if degree_of_learning is "low"
and motivation is "moderate"
then put "FI" into transaction
```

rule #3

```
if degree_of_learning is "high"
and motivation is "low"
```

```
   and familiarity is "moderate"
   then put "SCBI" into transaction

rule #4

   if degree_of_learning is "high"
   and motivation is "low"
   and familiarity is "low"
   then put "SCBI" into transaction

rule #5

   if degree_of_learning is "high"
   and motivation is "high"
   and familiarity is "moderate"
   then put "LCBI" into transaction

rule #6

   if degree_of_learning is "high"
   and motivation is "high"
   and familiarity is "low"
   then put "LCBI" into transaction

rule #7

   if degree_of_learning is "low"
   and motivation is "high"
   and familiarity is "low"
   then put "DC:LCBI" into transaction

rule #8

   if degree_of_learning is "low"
   and motivation is "high"
   and familiarity is "moderate"
   then put "DC:LCBI" into transaction

   if degree_of_learning is "low"
   and motivation is "high"
   and familiarity is "low"
   then put "DC:LCBI" into transaction

rule #9
```

```
   if degree_of_learning is "high"
   and motivation is "high"
   and familiarity is "high"
   then put "RLCBI" into transaction

rule #10

   if degree_of_learning is "low"
   and motivation is "high"
   and familiarity is "high"
   then put "DC:RLCBI" into transaction

rule #11

   if degree_of_learning is "high"
   and motivation is "low"
   and familiarity is "high"
   then put "RSCBI" into transaction

rule #12

   if degree_of_learning is "high"
   and motivation is "moderate"
   and familiarity is "high"
   then put "REM:SLCBI" into transaction

rule #13

   if degree_of_learning is "high"
   and motivation is "moderate"
   and familiarity is "moderate"
   then put "SLCBI" into transaction

rule #14

   if degree_of_learning is "high"
   and motivation is "moderate"
   and familiarity is "low"
   then put "SLCBI" into transaction

rule #15

   if degree_of_learning is "high"
   and motivation is "moderate"
```

and familiarity is "high"
then put "RSLCBI" into transaction

Adjustments based on content structure type:

if type is "kinds-of" or type is "parts-of"
and transaction is "RLCBI"
then put "REM:LCBI" into transaction

if (type is "kinds-of" or type is "parts-of")
and transaction is "RSCBI"
then put "REM:SCBI" into transaction

if (type is "kinds-of" or type is "parts-of")
and transaction is "DC:LCBI"
then put "DP:LCBI" into transaction

See the section Systems Outputs for information about the transaction strategies recommended by this consultation.

4.4 System Outputs

Output from ID Expert is a recommended course organization and a set of recommended transaction strategies.

4.4.1 Course Organization

Course organization is represented by a flow chart that is drawn dynamically based on the content structure and the reasoning contained in the course organization frame.

This flow chart indicates control structures (menus/or decisions indicated by diamonds), integrative modules (preintegrative and postintegrative indicated by rounded rectangles), maps consisting of more detailed course organization nested within a higher level of organization (indicated by shadowed rectangles) and instructional modules (indicated by rectangles).

Control structures (diamonds) indicate that the student or the system will make a choice of the next module or map (set of modules) that a given student should study. [The prototype version of ID EXPERT has not yet implemented prescriptions for course level control structures.]

Integrative modules (rounded rectangles) indicate overviews, pretests, posttests and other instructional transactions which integrate the content from several modules. [The prototype version of ID EXPERT has not yet implemented detailed prescriptions for integrative modules.]

Maps (shadowed rectangles) indicate that a set of modules are nested within the course organization at this point. There can be as many levels of nesting as are necessary to provide the necessary instructional modules to teach the content specified by the content structure. You can see the nested course organization by selecting Expand from the pop-up menu associated with a map rectangle.

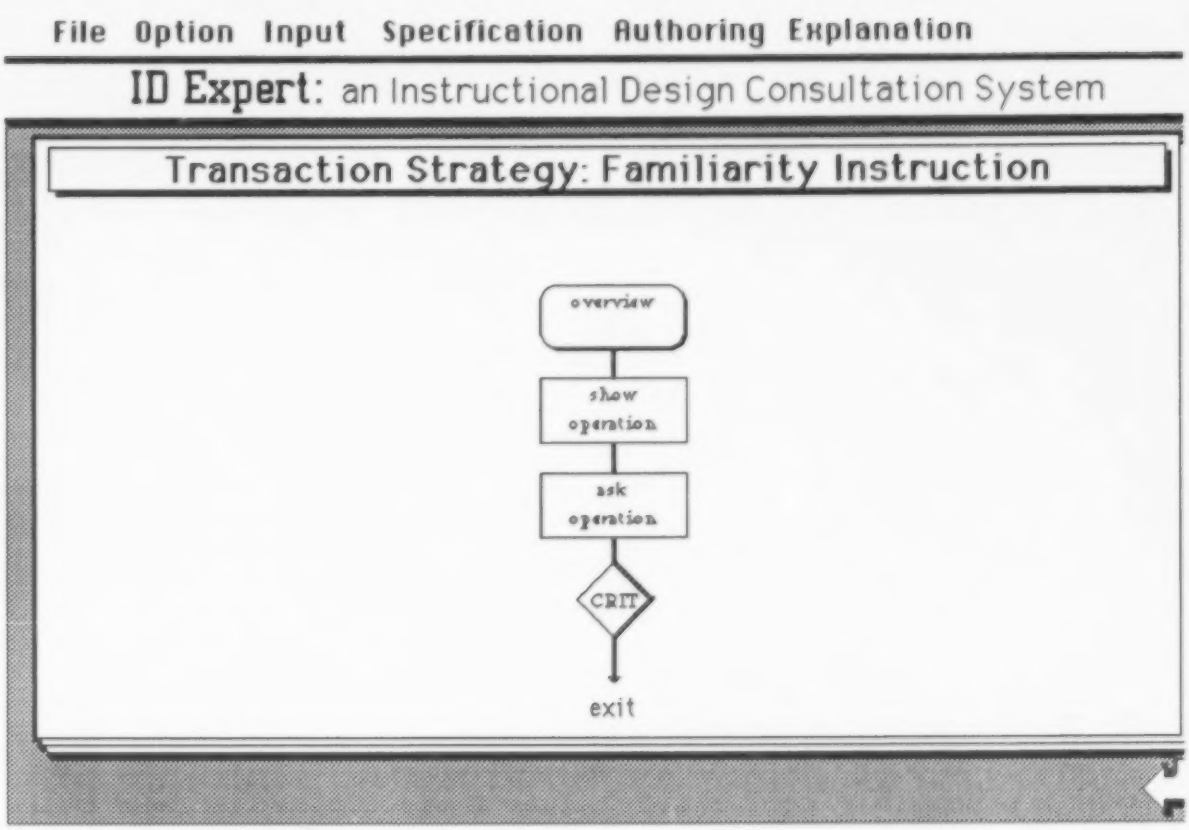
Instructional modules (rectangles) indicate a unit of instruction which will teach a given set of content information. You can drag to the pop-up menu associated with each module to get a list of the content topics included in the module or to get the instructional objective associated with the module. Each module is also associated with a transaction strategy consisting of a set of individual interactions with the student. ID EXPERT uses its reasoning capabilities to recommend a transaction strategy for each module. You can see the transaction strategy recommended for a given module by selecting Transactions from the pop-up menu associated with each module.

An example course organization frame is shown in the section "Sample Session".

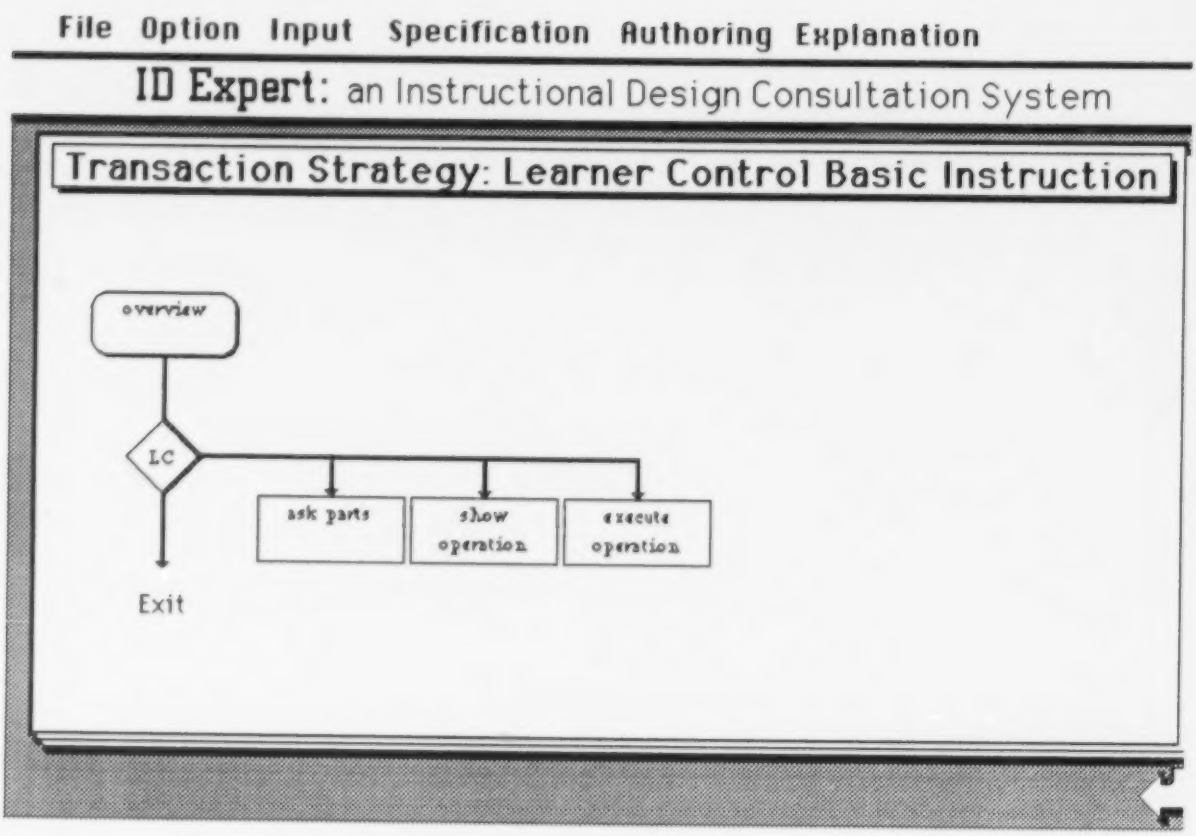
4.4.2 Transaction Strategy

Each transaction strategy has associated a frame. There are 13 of these frames.

Familiarity Instruction (FI)



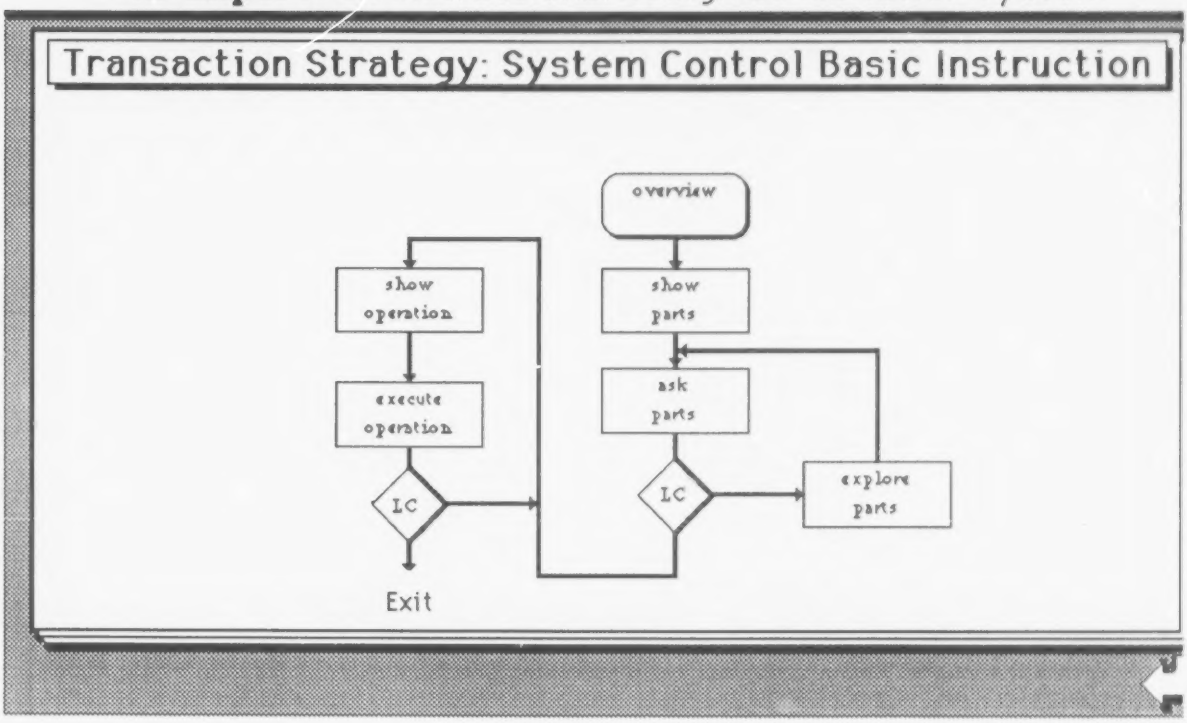
Learner Control Basic Instruction (LCBI)



System Control Basic Instruction (SCBI)

File Option Input Specification Authoring Explanation

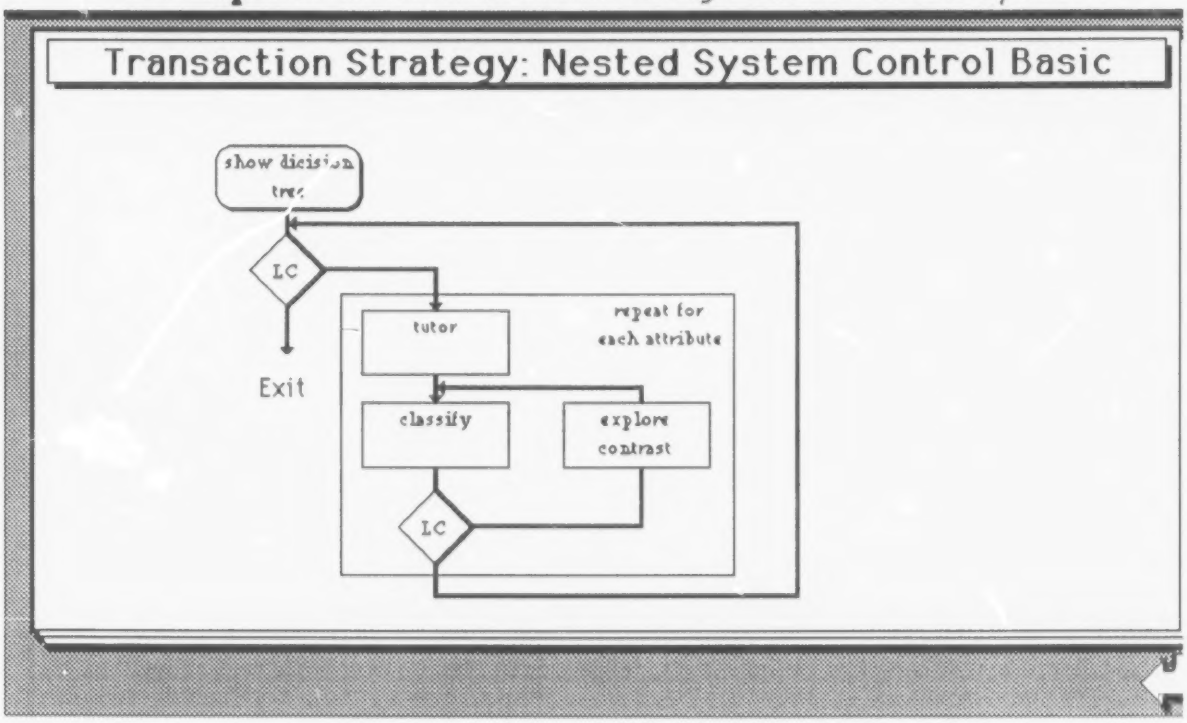
ID Expert: an Instructional Design Consultation System



Nested System Control Basic Instruction (SCBI:ATTR)

File Option Input Specification Authoring Explanation

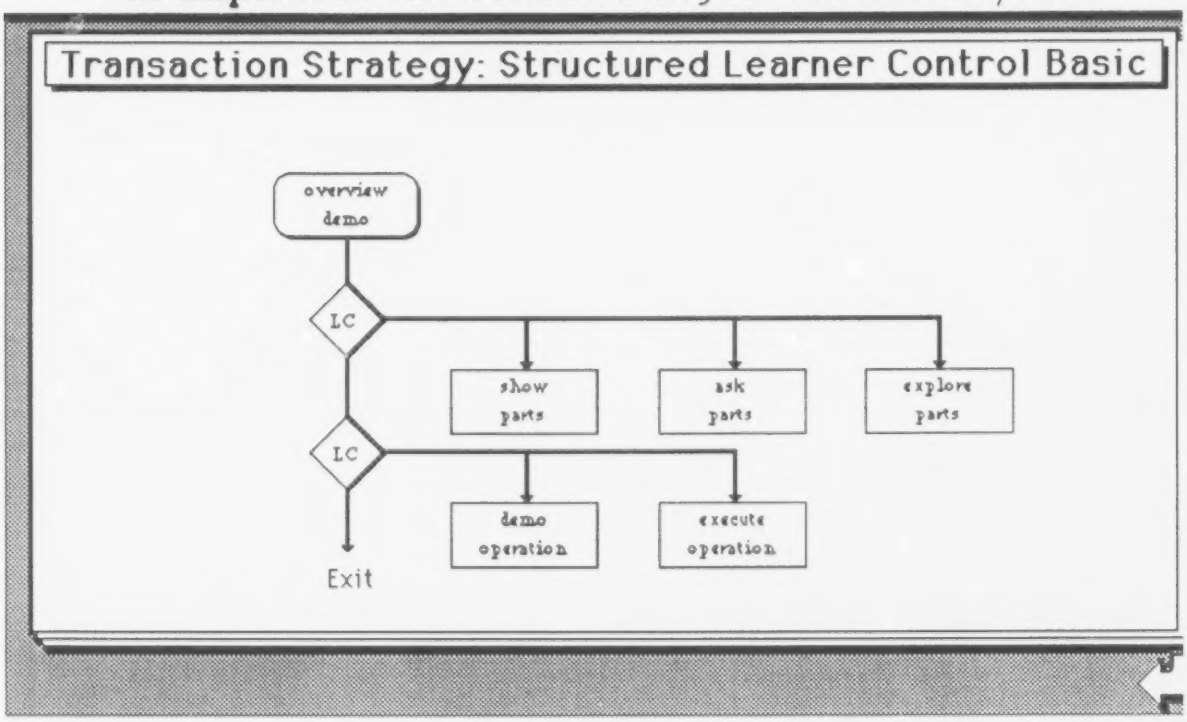
ID Expert: an Instructional Design Consultation System



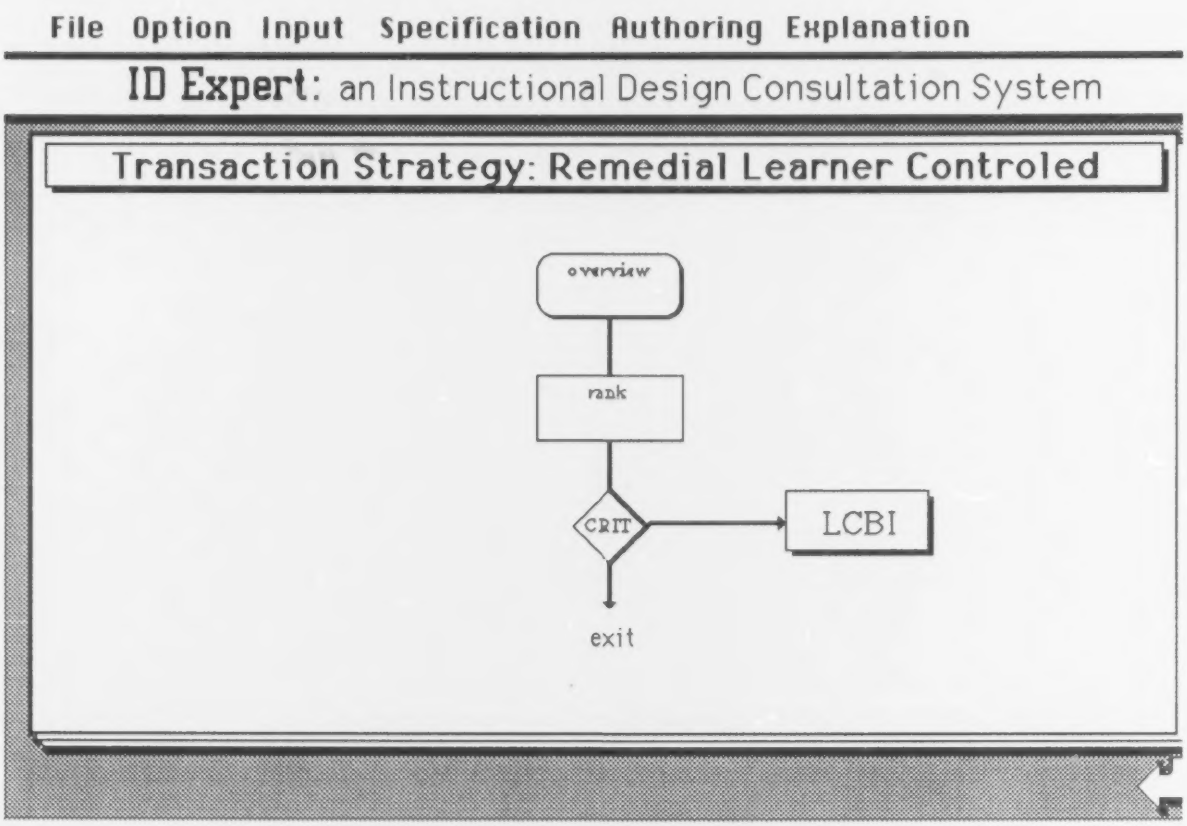
Structured Learner Control Basic Instruction (SLCBI)

File Option Input Specification Authoring Explanation

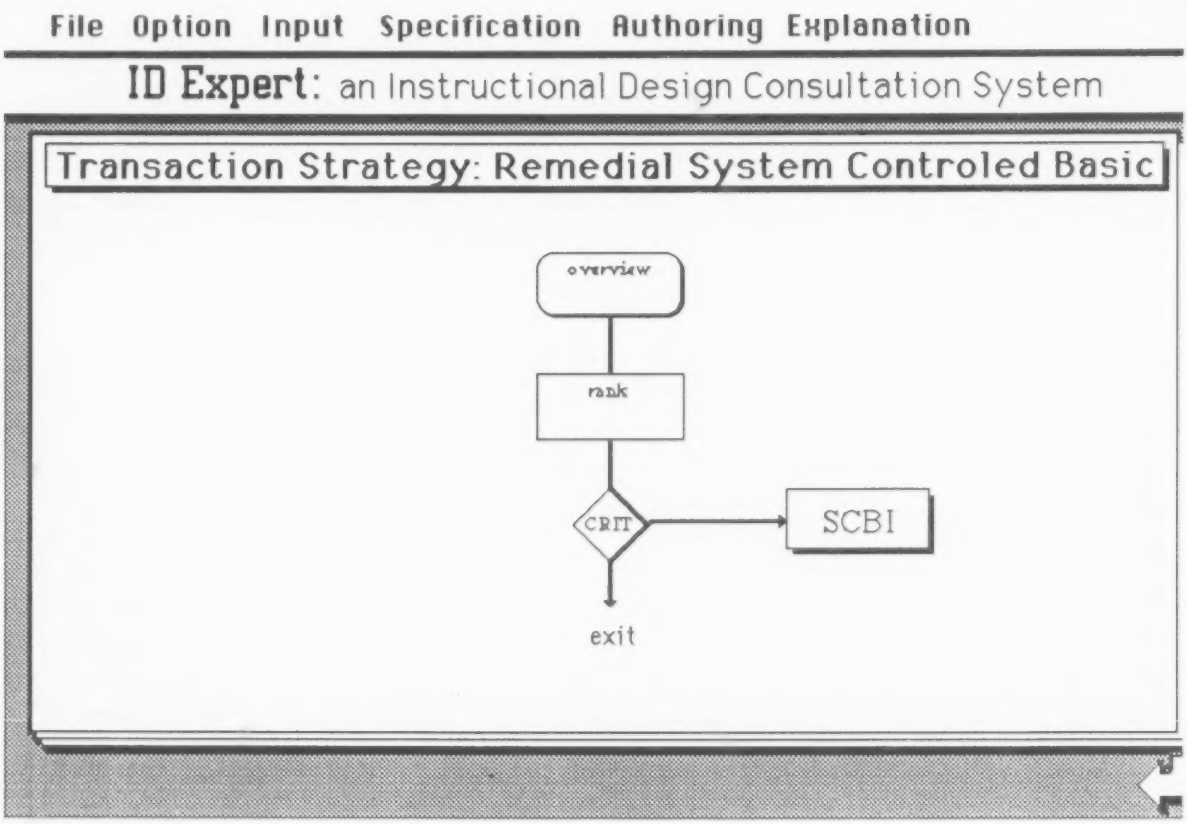
ID Expert: an Instructional Design Consultation System



Remedial Learner Control Basic Instruction (Rem:LCBI)



Remedial System Control Basic Instruction (Rem:SCBI)

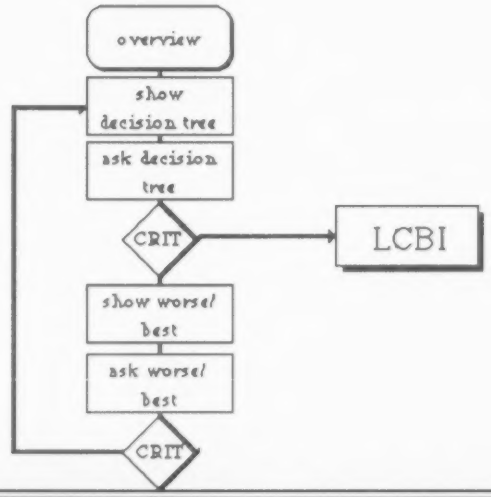


Depth Choice Learner Control Basic Instruction (DP:LCBI)

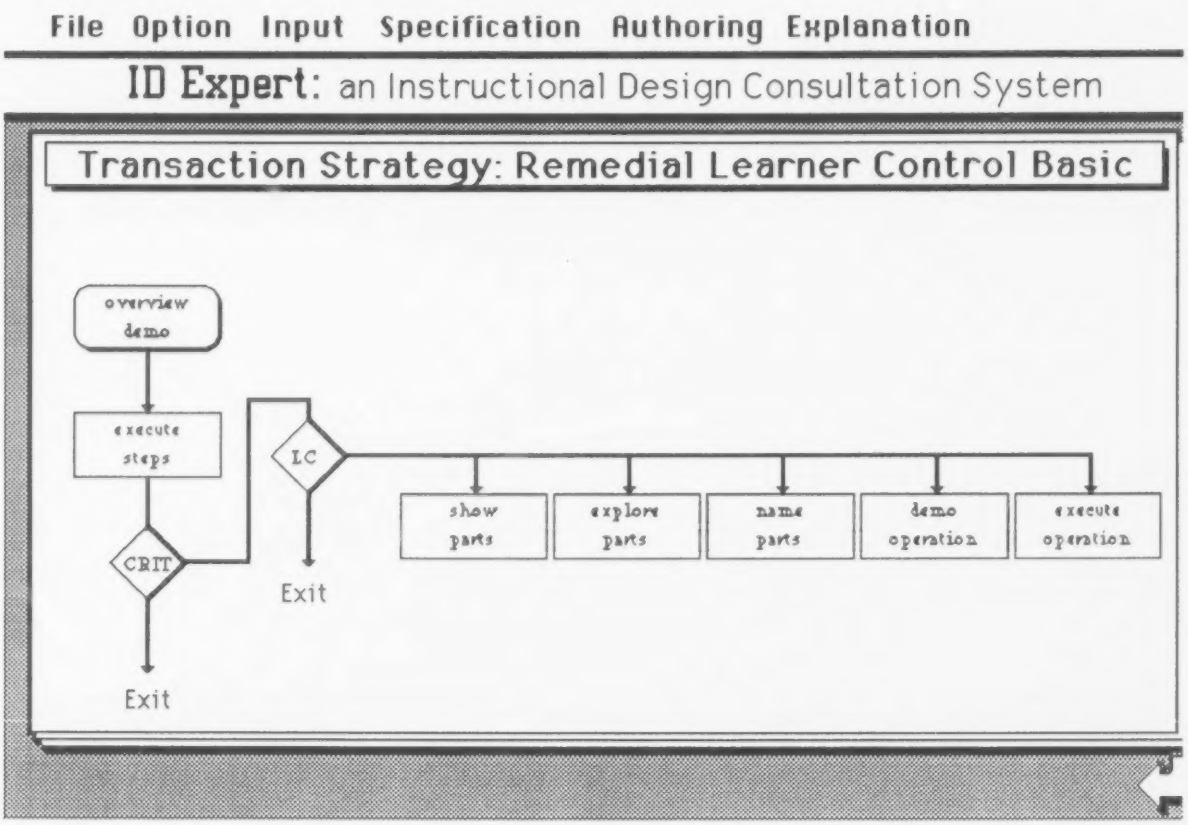
File Option Input Specification Authoring Explanation

ID Expert: an Instructional Design Consultation System

Transaction Strategy: Depth Choice:Learner Controled



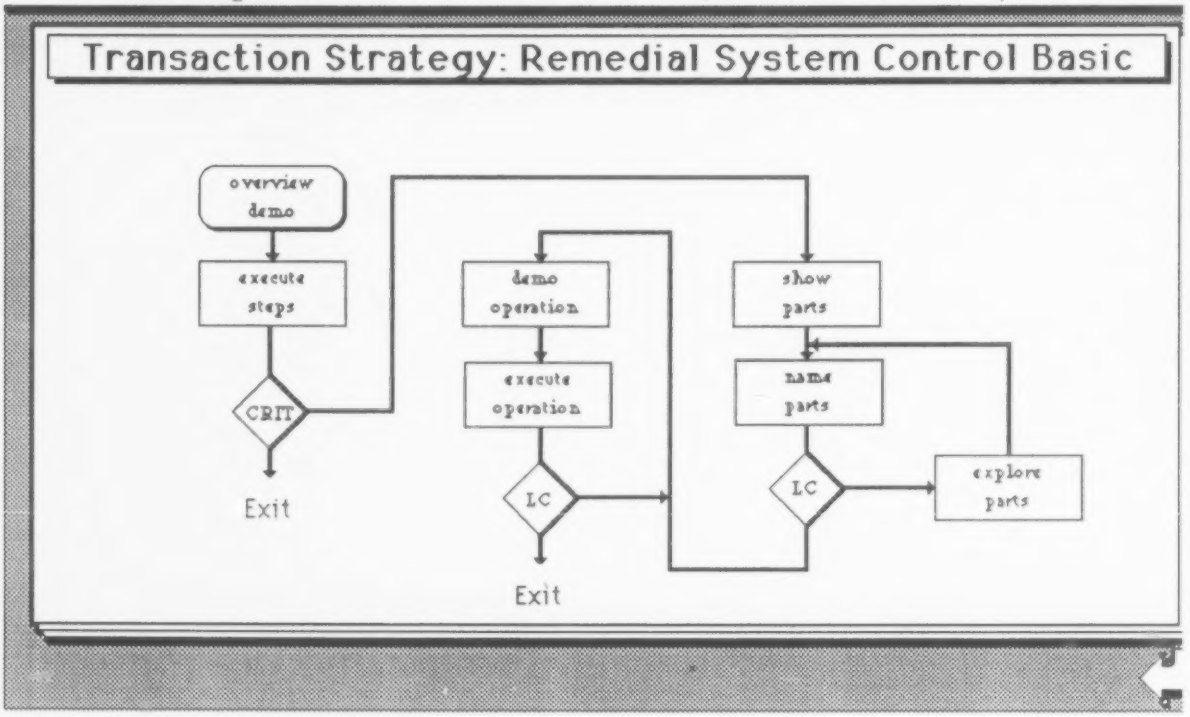
Remedial Learner Control Basic Instruction (RLCBI)



Remedial System Control Basic Instruction (RSCBI)

File Option Input Specification Authoring Explanation

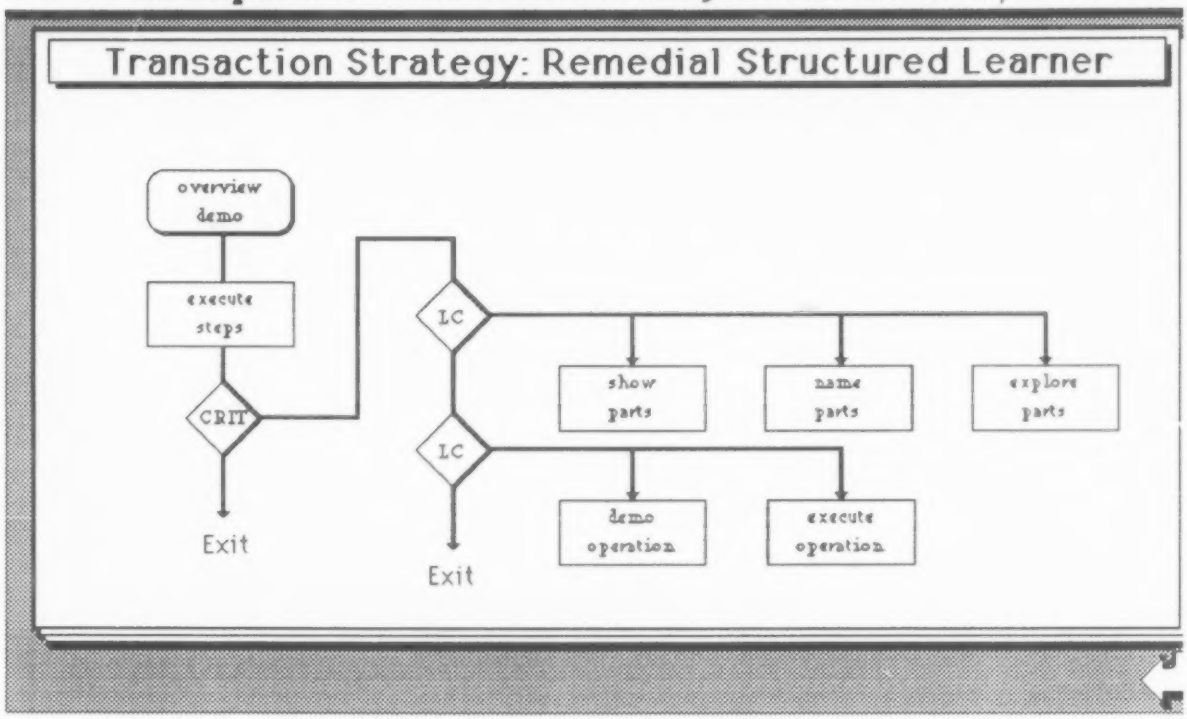
ID Expert: an Instructional Design Consultation System



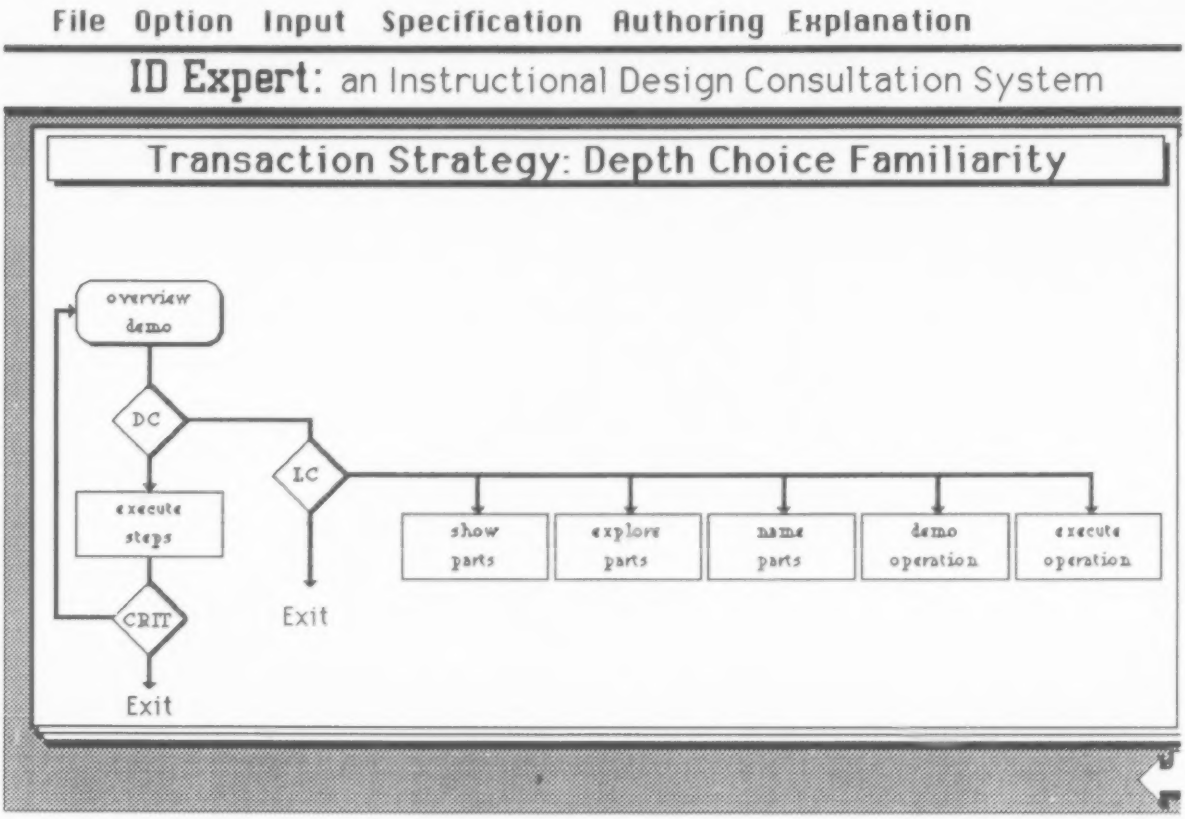
Remedial Structured Learner Control Basic Instruction (RSLCBI)

File Option Input Specification Authoring Explanation

ID Expert: an Instructional Design Consultation System



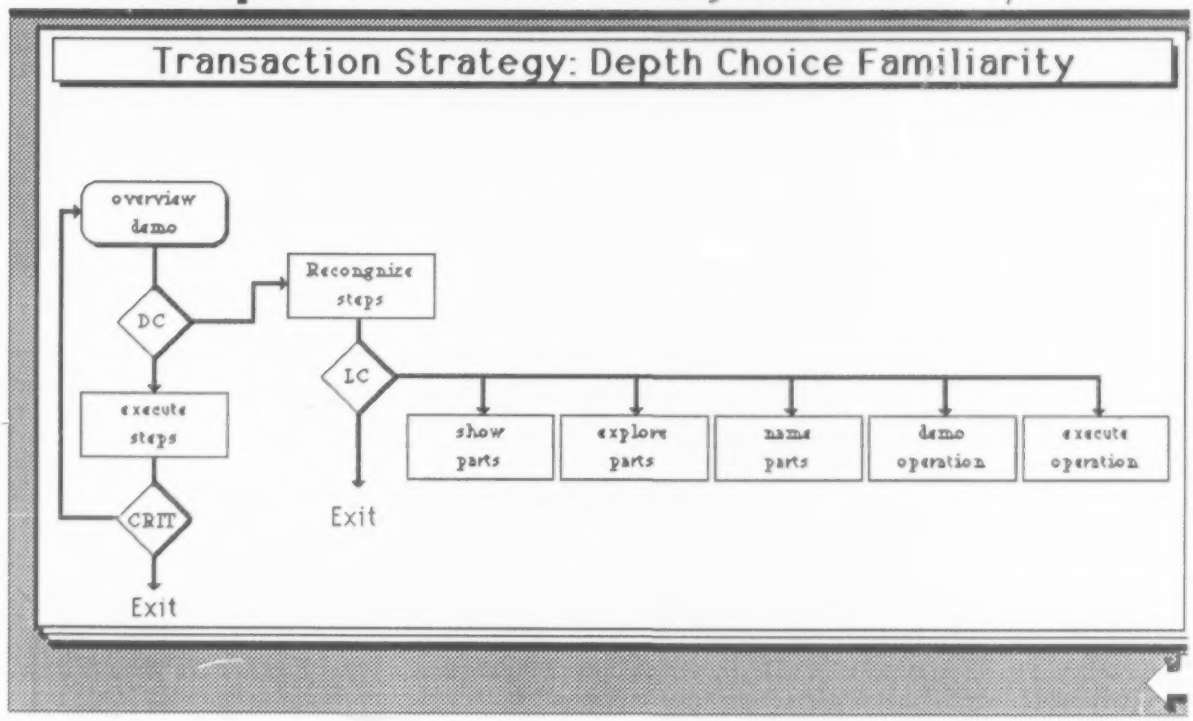
Depth Choice Familiarity Instruction with LCBI (DC:LCBI)



Depth Choice Familiarity Instruction with Remedial LCBI (DC:RLCBI)

File Option Input Specification Authoring Explanation

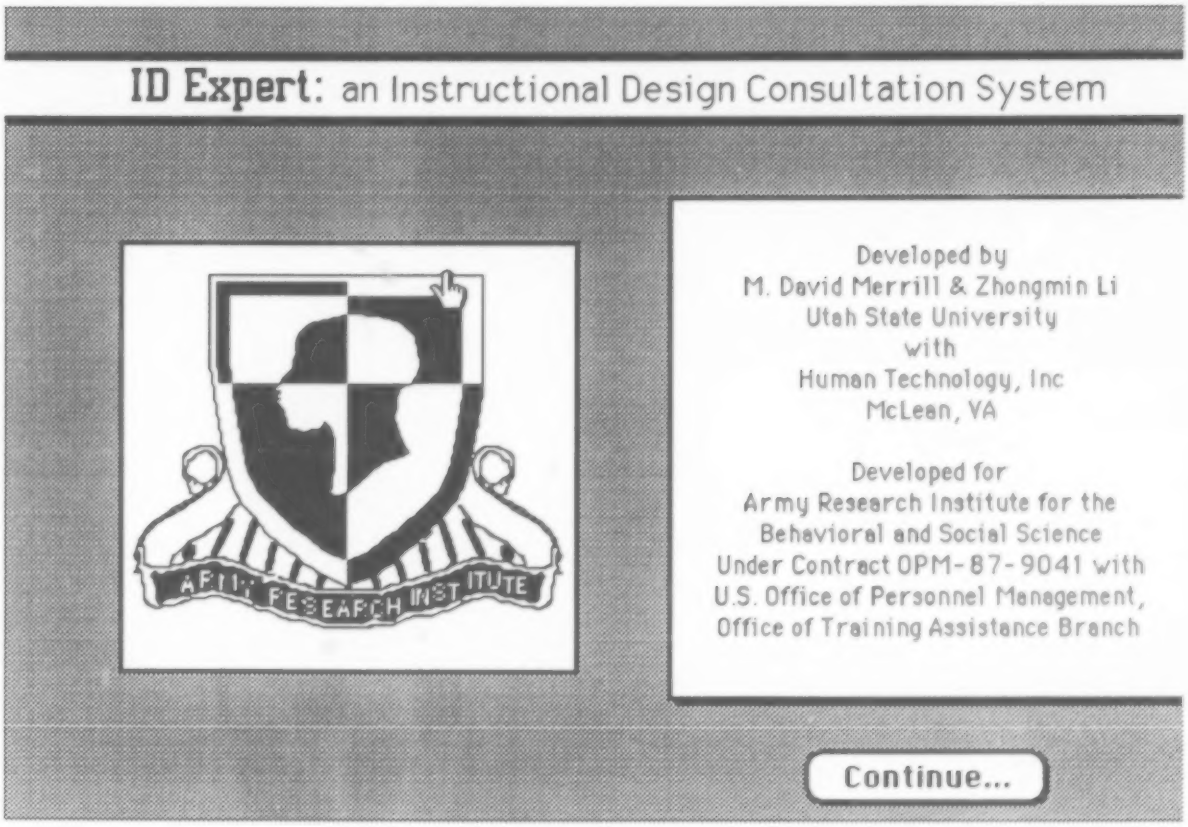
ID Expert: an Instructional Design Consultation System



5.0 Sample Session including Transcript

In the following sample session, part of course to teach operation of an M.1 Control Panel is designed. For each step in the design, the frame that would be seen by the user is pictured, along with a text description of the user actions.

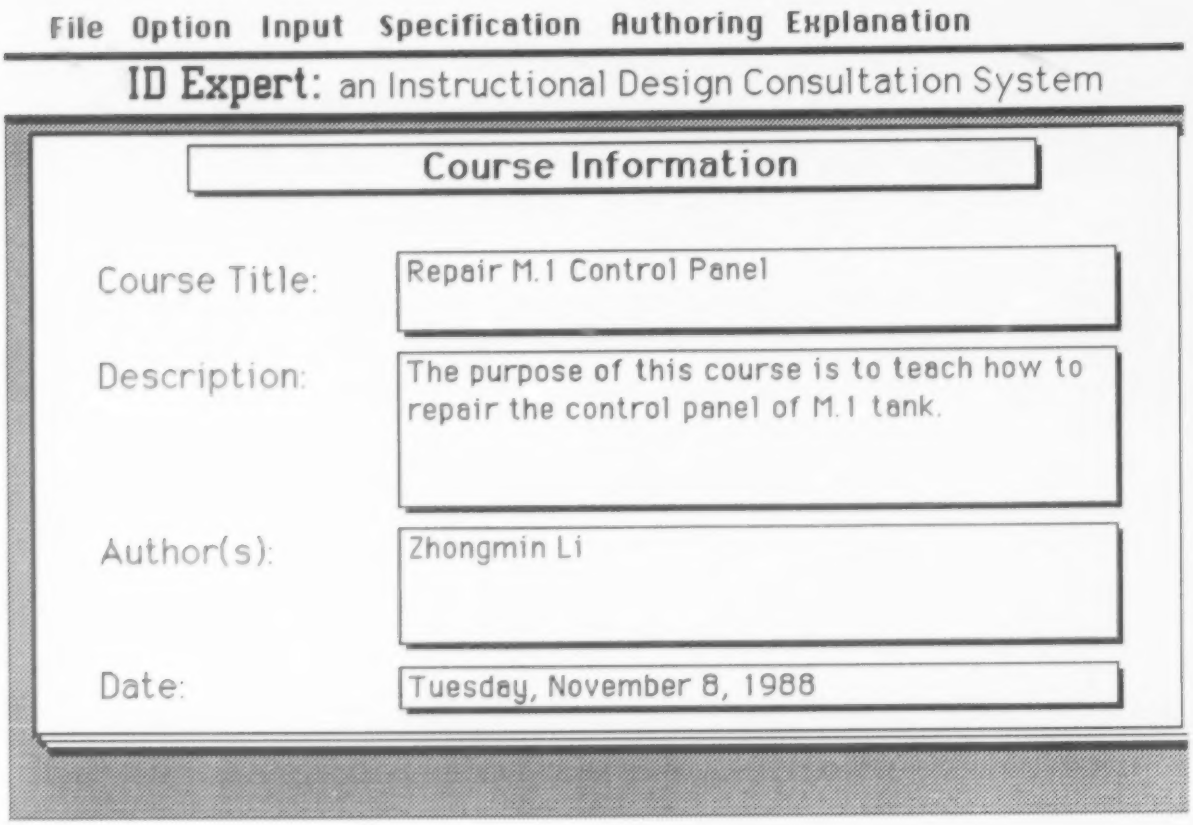
Running ID Expert requires Hypercard, plus the hypercard stacks (files) "ID Expert", "Transaction KB", "Motivation KB", and the replacement of the "home" stack with the ID Expert "home" stack. Begin by clicking twice on the ID Expert icon to initiate program execution.



- click once on continue

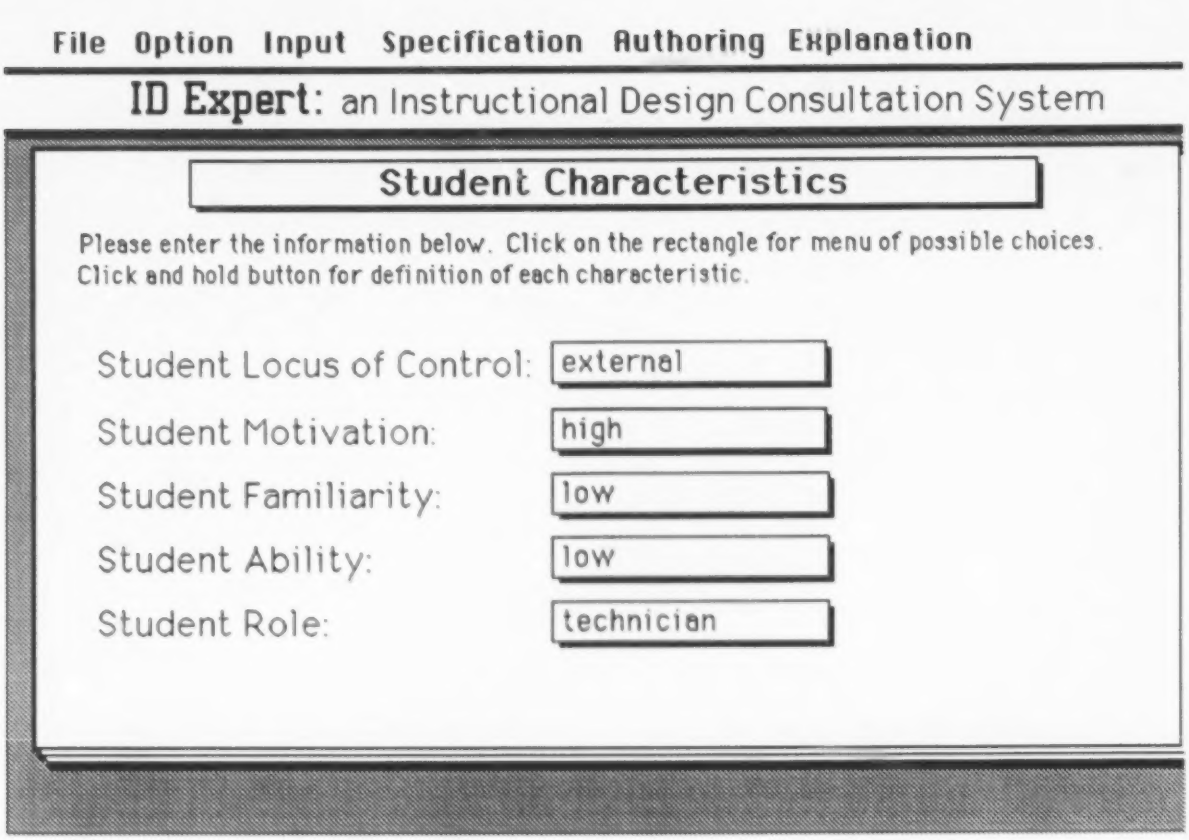
The **Course Information** frame appears (blank).

- select *new course* from the *file* menu
- enter "control panel" in the dialog box


File Option Input Specification Authoring Explanation
ID Expert: an Instructional Design Consultation System
Course Information
Course Title:
Repair M.1 Control Panel
Description:
The purpose of this course is to teach how to repair the control panel of M.1 tank.
Author(s):
Zhongmin Li
Date:
Tuesday, November 8, 1988

The **Course Information** frame appears (blank, except for the date field) for the new course

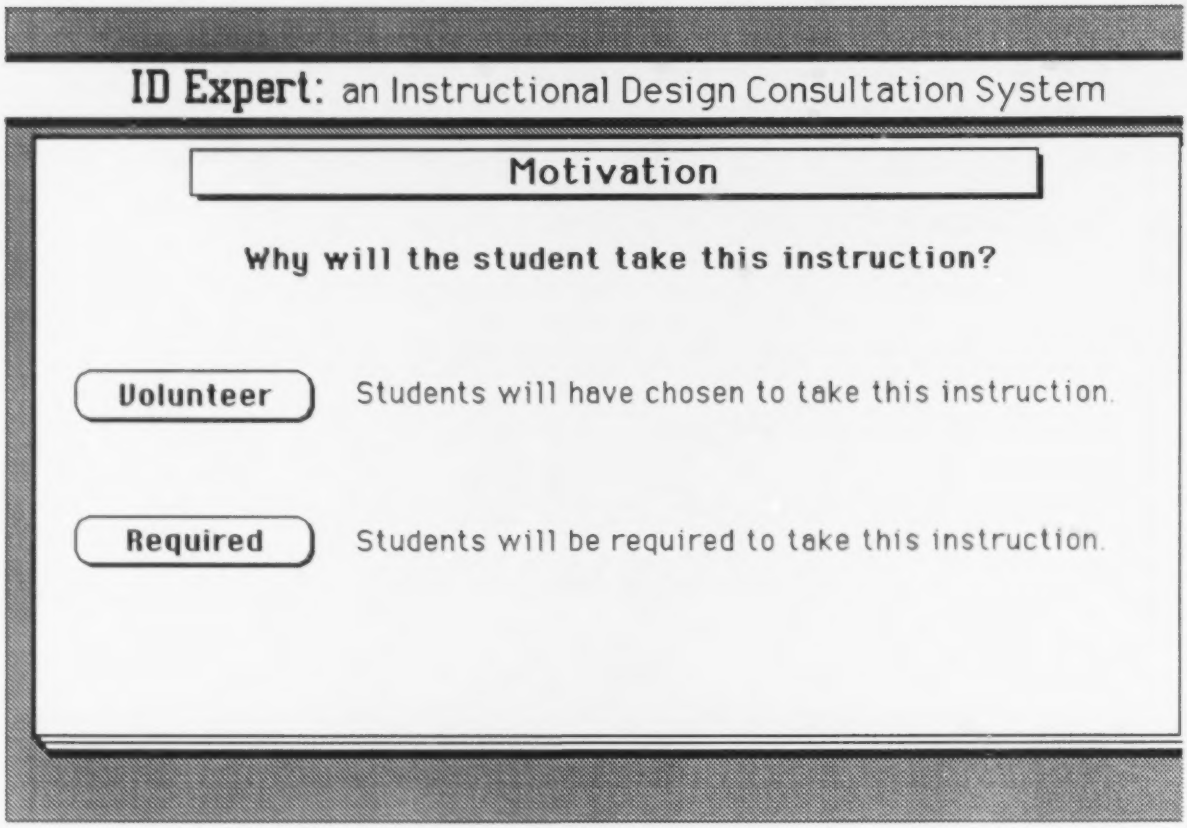
- enter a title, description, and the author
- select *student characteristics* from the *Input* menu


File Option Input Specification Authoring Explanation
ID Expert: an Instructional Design Consultation System
Student Characteristics
Please enter the information below. Click on the rectangle for menu of possible choices.
Click and hold button for definition of each characteristic.
Student Locus of Control: external
Student Motivation: high
Student Familiarity: low
Student Ability: low
Student Role: technician

The **Student Characteristics** frame appears (blank).

For each of the blank fields, choose a value from the popup menu that appears when you click and hold on that field.

- choose a value for locus of control
- choose a value for familiarity
- choose a value for ability
- choose a value for role
- for motivation, select *prescribe* to initiate consultation


ID Expert: an Instructional Design Consultation System
Motivation
Why will the student take this instruction?
Volunteer
Students will have chosen to take this instruction.
Required
Students will be required to take this instruction.

Motivation expert system executes. Answers questions presented in screens such as this one. When consulation if finished, will return to the student characteristics frame.

- select *content information* from *input* menu

File Option Input Specification Authoring Explanation

ID Expert: an Instructional Design Consultation System

Course Goal

Goal	Label	Identifier	Note	Entity	Activity	Process	Cause
1	45K-35-G	Repair M.1 Control Panel	☐	☒	☒	☐	☐
2							
3							
4							
5							
6							
7							

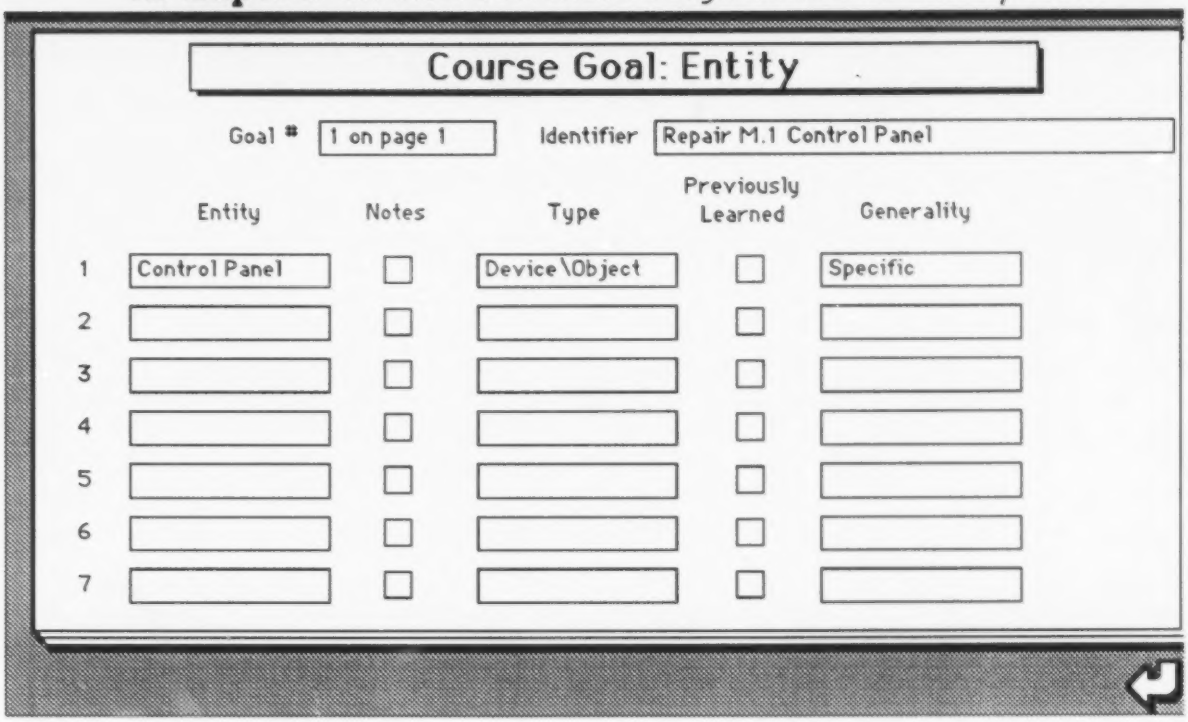
1

Course Goal frame appears (blank).

- select *add goal* from the popup menu on the *label* field
  - enter a label for the goal in the dialog box that appears
  - enter an identifier for the goal in the dialog box
- click once on the *entity* box to go to the entity frame

File Option Input Specification Authoring Explanation

ID Expert: an Instructional Design Consultation System



The **Entity** frame appears (blank).

- select *add entity* from the popup menu on the *entity* field
  - enter name for the entity in the dialog box
- choose the entity type from the popup menu on the *type* field
- choose generality from the popup menu on the *generality* field
- click on the arrow in the lower right hand corner to return to the goal frame

Course Goal frame reappears

- select *add activity* from the popup menu on the *activity* field

File Option Input Specification Authoring Explanation

ID Expert: an Instructional Design Consultation System

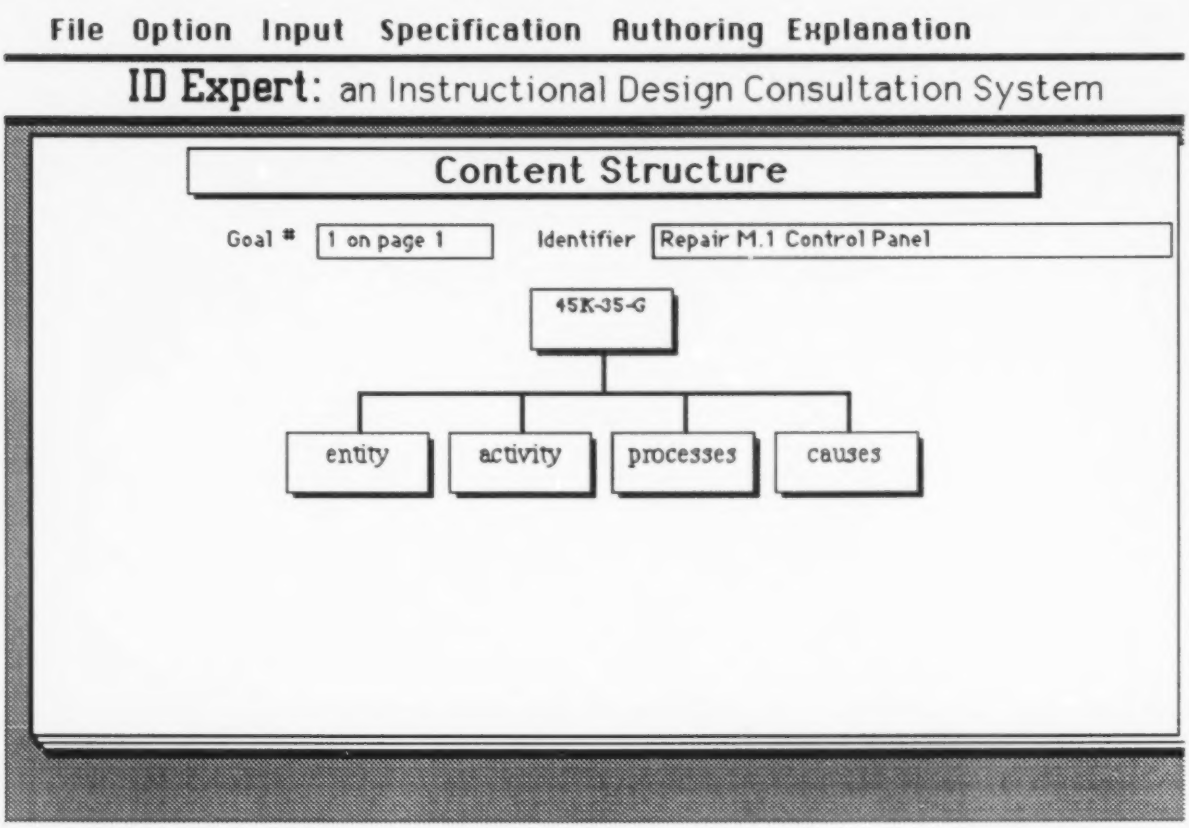
Course Goal: Activity

Goal # 1 on page 1 Identifier Repair M.1 Control Panel

	Activity	Entities	Note	Type	PL	Generality	Condition	Limitation
1	Repair	Control Panel	☐	Assemble	☐	Specific	Invariable	Instruction
2			☐		☐			
3			☐		☐			
4			☐		☐			
5			☐		☐			
6			☐		☐			
7			☐		☐			

Activity frame appears (blank).

- select *add activity* from the popup menu on the *activity* field
  - enter a name in the dialog box
- choose an entity from the popup menu on the *entity* field (this menu contains the names of the entities entered for this goal)
- choose a type from the popup menu on the *type* field
- choose a generality from the popup for the *generality* field
- choose a condition from the popup for the *condition* field
- choose a limitation from the popup for the *limitation* field
- click on the arrow in the lower right hand corner to return to the goal frame
- Goal frame reappears.
- select *content structure* from the *specification* menu
  - choose a goal from the menu that appears

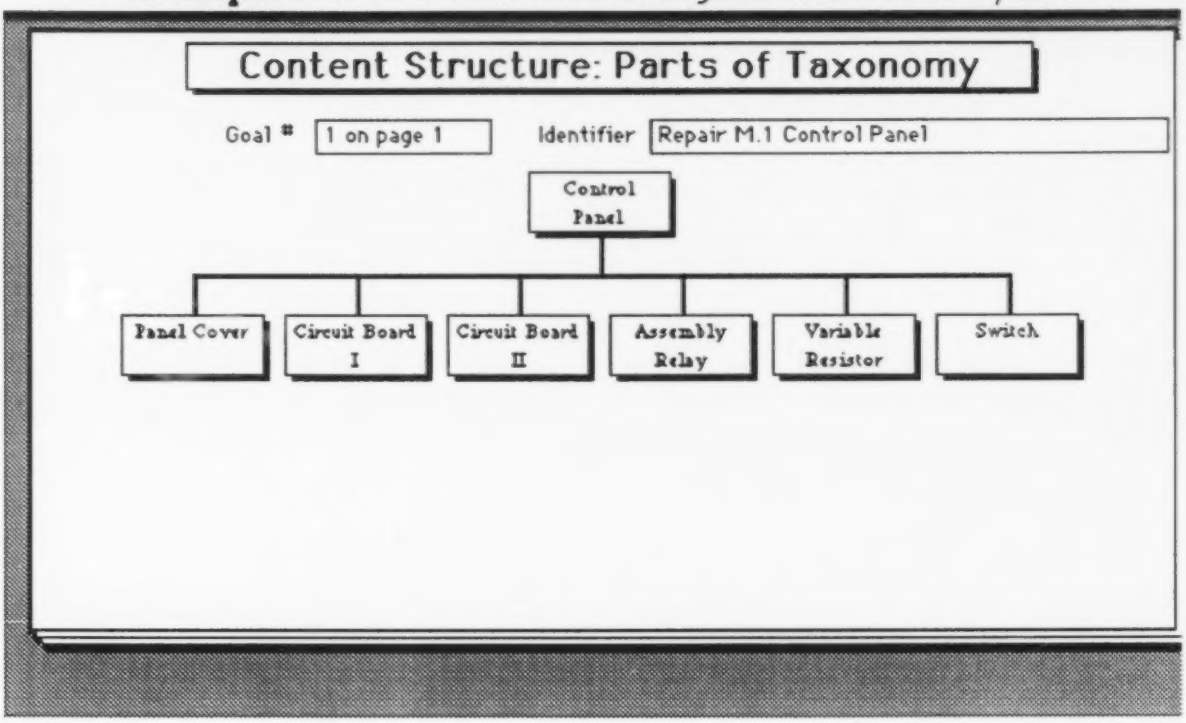


The **Content Structure** frame appears.

- select *expand* from the popup menu on the *entity* box
- box for *control panel* appears
- select *sub-parts* from the popup menu on the *control panel* box
    - enter the number of sub-parts into the dialog box
    - empty sub-parts boxes appear
    - select *label* from the popup menu on the first empty box
        - enter a label
    - repeat for all the boxes

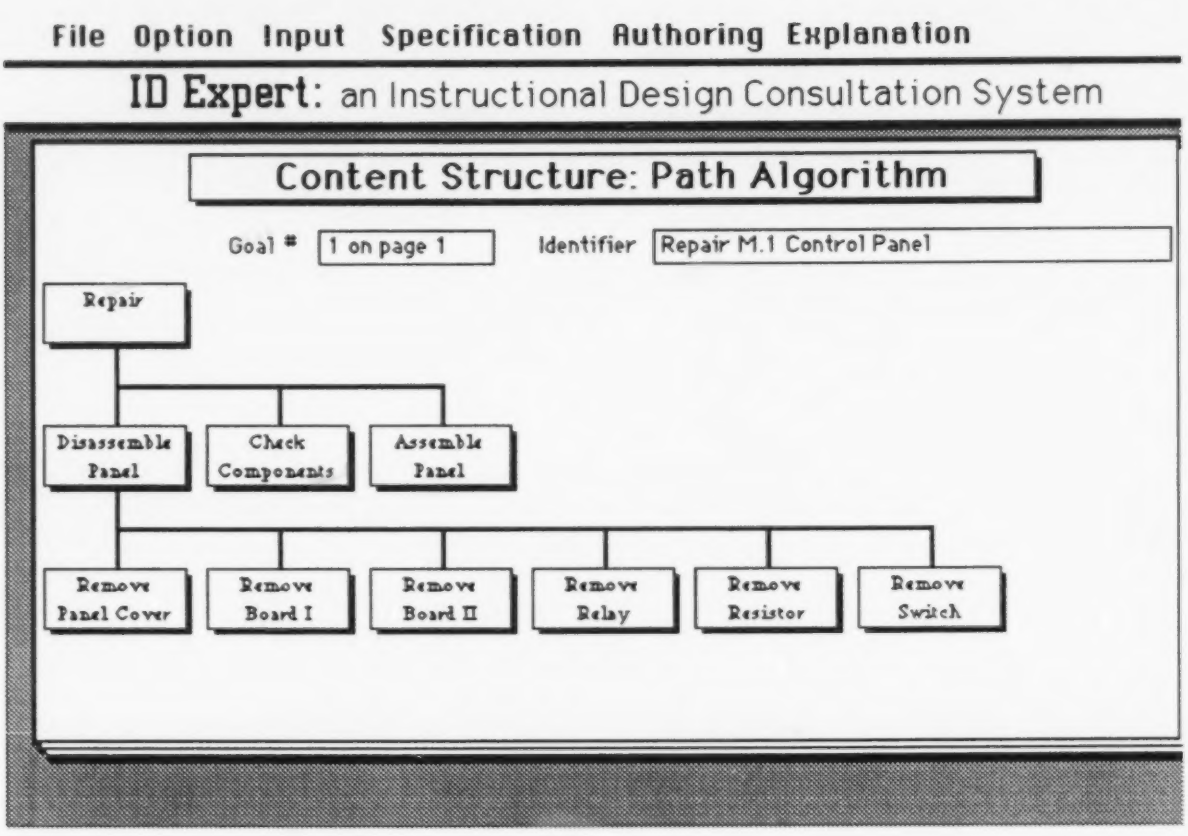
File Option Input Specification Authoring Explanation

ID Expert: an Instructional Design Consultation System



Completed **Parts-of Taxonomy** frame

- select *collapse* from the popup menu on the *control panel* box
- Content Structure frame reappears
- select *expand* from the popup menu on the *activity* box
- box for *repair* appears
- select *steps* from the popup menu on the *repair* box
    - enter the number of steps into the dialog box
    - empty boxes appear for the steps
    - select *label* from the popup menu on the first empty box
        - enter a label
    - repeat for all the steps

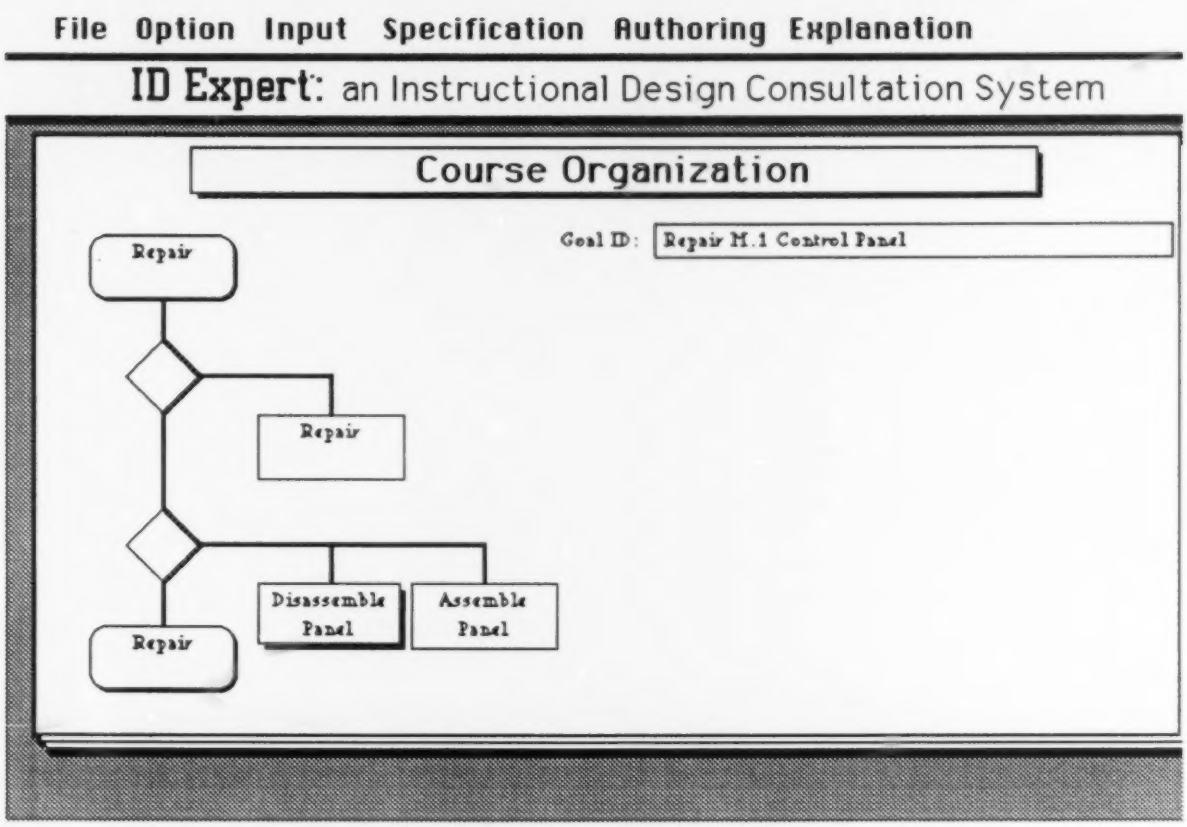


Completed **Path Algorithm** frame

- select *collapse* from the popup menu on the *repair* box
- Content Structure frame reappears

The course organization for the entity is displayed from the part-of taxonomy frame. For the activity, it is displayed from the path algorithm frame. This example will demonstrate the activity course organization.

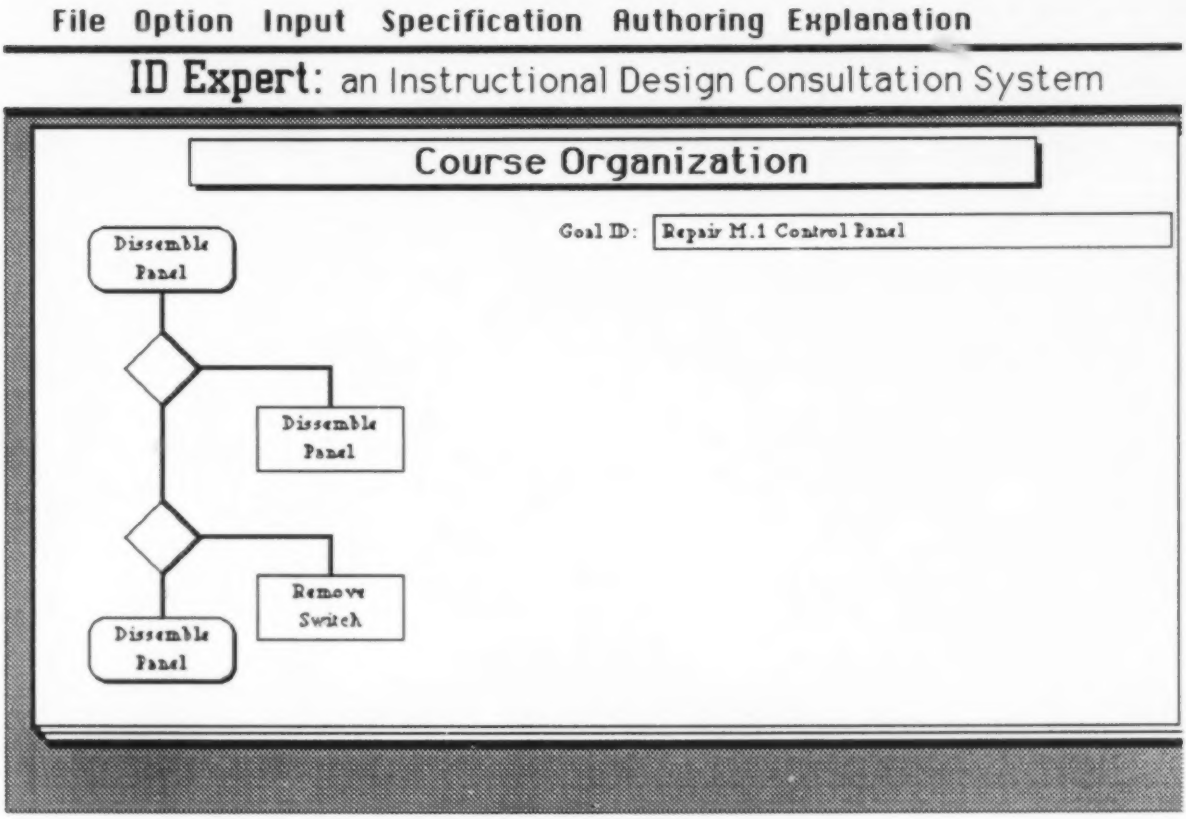
- From the Path Algorithm frame select *Course Organization* from the *specification* menu



The **Course Organization** frame for the *repair* activity appears.

To show the course organization for the sub-activity *dissassemble panel* (indicated by the shadow on the box),

- select *subordinate* from the popup menu on *dissassemble panel*

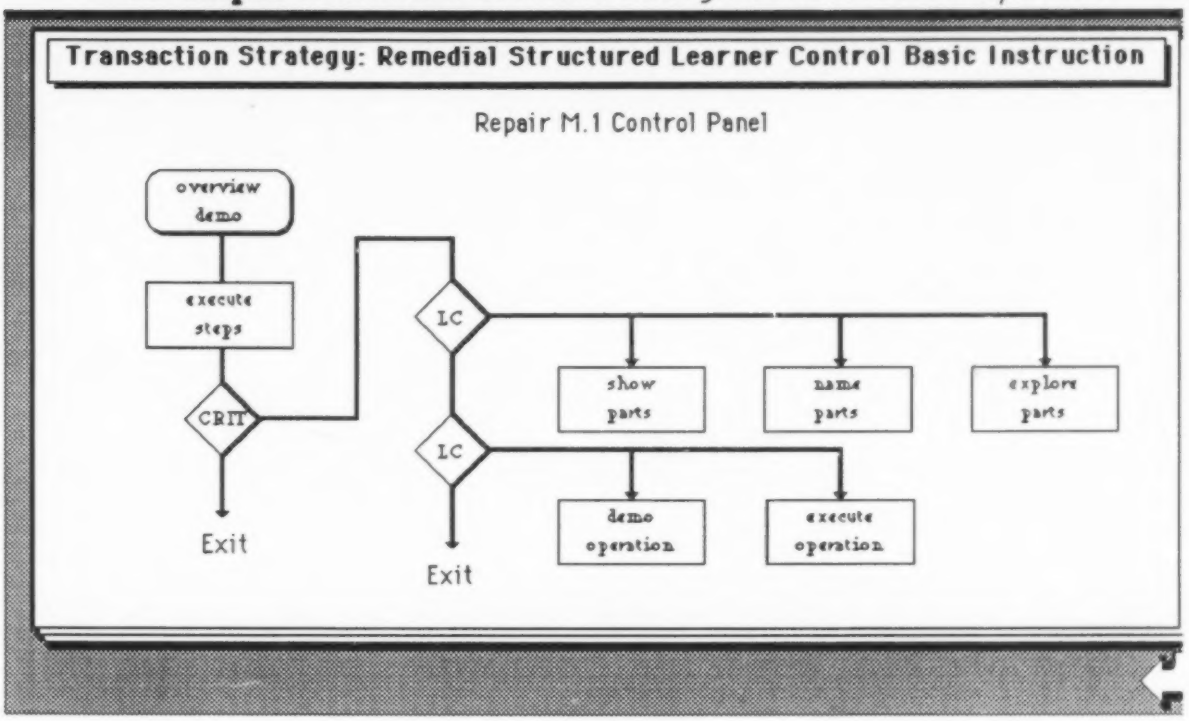


Course Organization frame for the activity *disassemble panel.*

- select *superordinate* from the popup menu on the topmost *disassemble panel* node.
- Course Organization frame for the activity *repair* reappears.
- select *transaction strategy* from the popup menu for the module (rectangle) *repair*

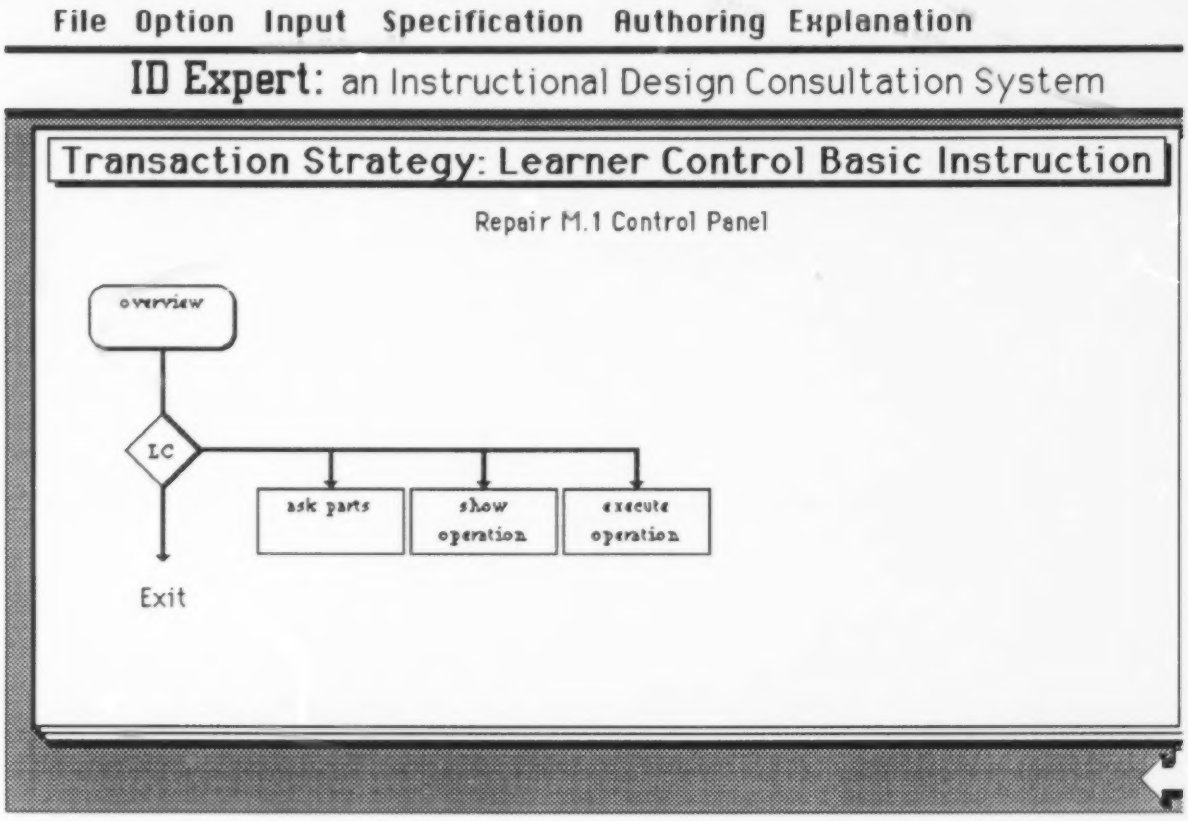
File Option Input Specification Authoring Explanation

ID Expert: an Instructional Design Consultation System



Transaction Strategy frame for the module *repair*.

- click on arrow in lower right hand corner to return to course organization frame
- course organization frame reappears
- select *transaction strategy* from the popup menu on the module *assemble panel*



Transaction Strategy frame for the module *assemble panel.*

- click on arrow in lower right hand corner to return to the course organization frame
- display transaction strategies for other modules in a similar fashion

To demo a transaction, click on a module and select *demo the transaction* from the popup menu. A prepared demo will activate.

To exit ID Expert

- select *quit ID Expert* from the *file* menu

Appendix Printout of Knowledge Bases